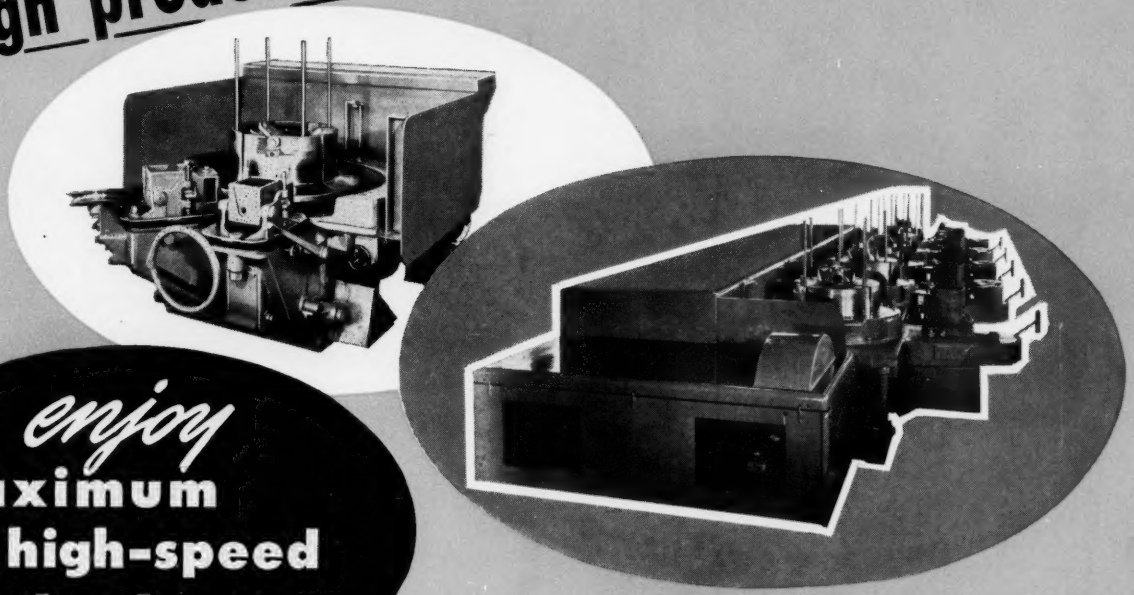
WIRE AND WIRE PRODUCTS

JANUARY 1949

tough production schedules?



enjoy maximum high-speed output with

Vaughn

WIRE DRAWING MACHINERY

Vaughn MOTOBLOC and MOTOBLOX provide the speed that holds wire drawing production at top level—months and years around. They have what it takes to deliver what you need! *Write for the facts.*

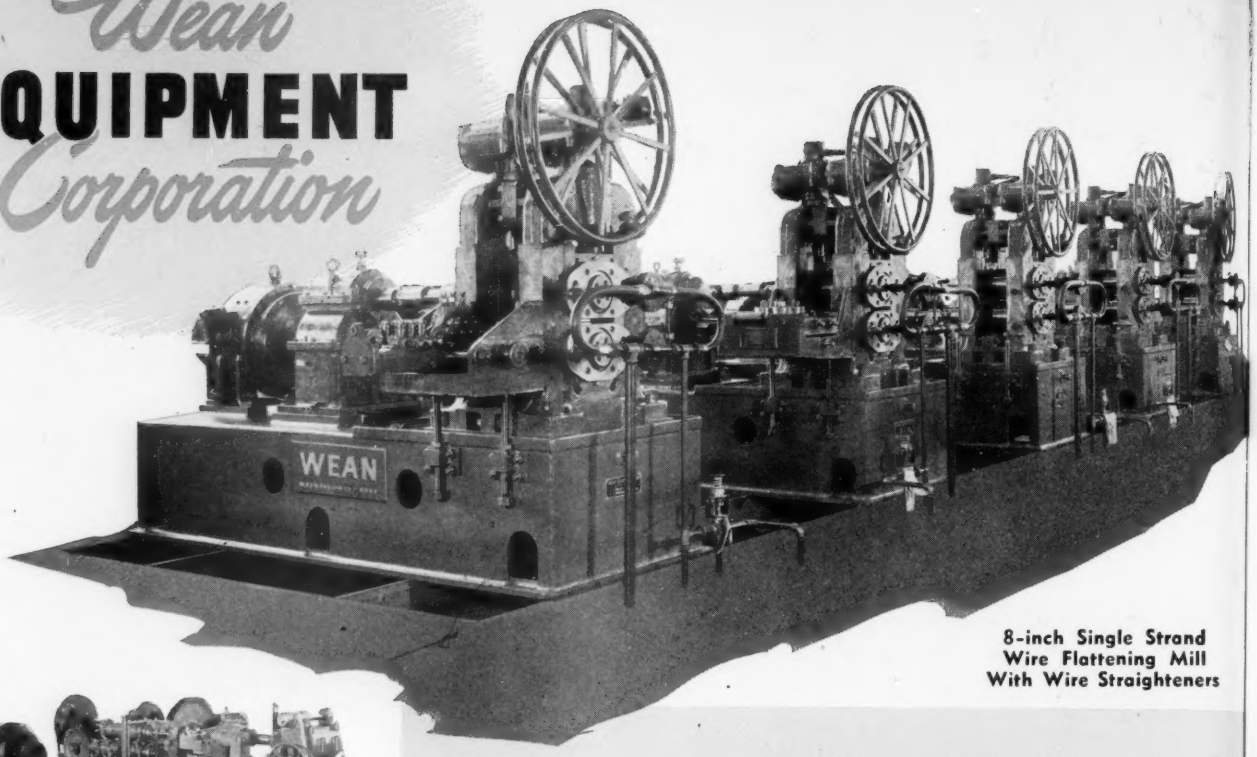
THE VAUGHN MACHINERY COMPANY
CUYAHOGA FALLS, OHIO, U. S. A.

COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

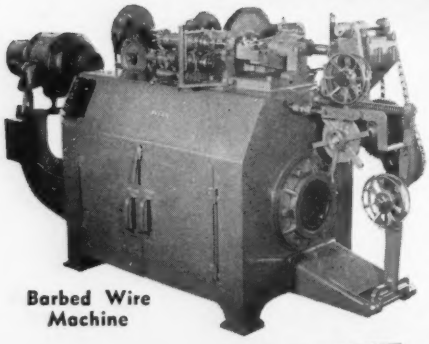
V
"Quick on the Draw!"
VAUGHN MACHINERY
PROFITABLY USED BY LEADING WIRE MILLS SINCE 1871

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

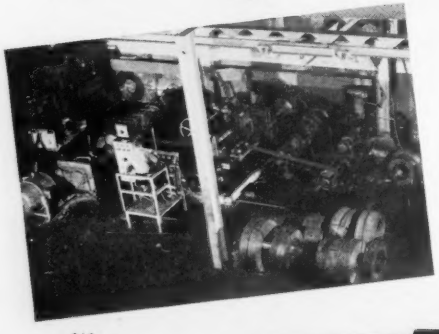
Wean EQUIPMENT Corporation



8-inch Single Strand
Wire Flattening Mill
With Wire Straighteners



Barbed Wire
Machine



Wean
Slitting Line

The WEAN EQUIPMENT CORPORATION is recognized a
a specialist in high-efficiency strip and wire mill equipment

COLD ROLLING MACHINERY

For 36" Wide Material and Narrower

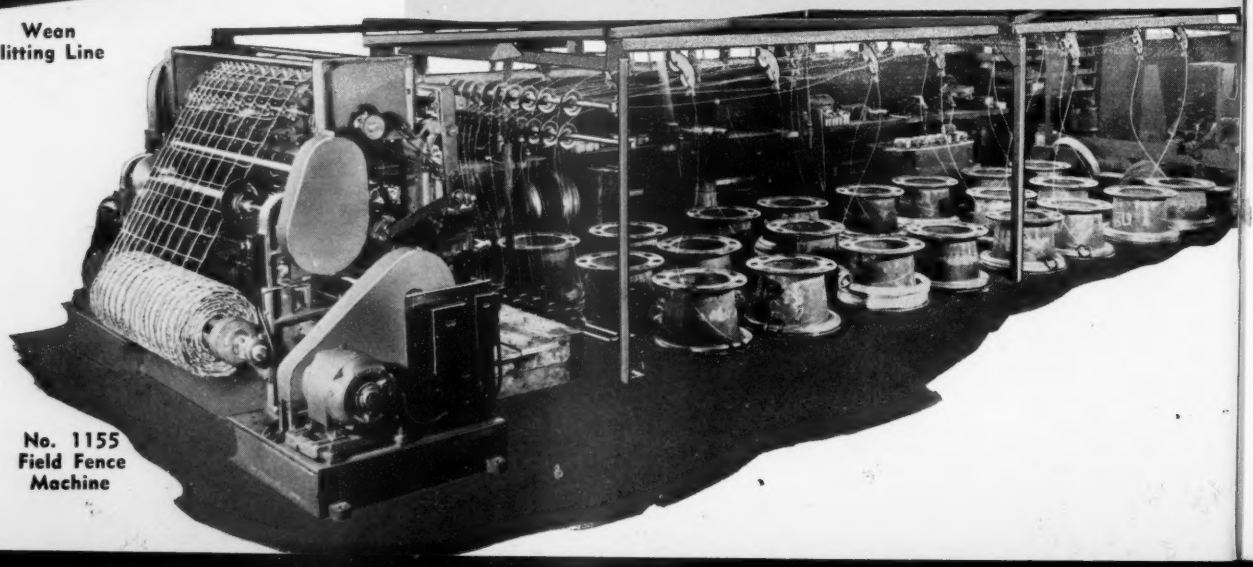
MILLS — REELS — SLITTERS — LEVELERS
COILERS — EDGERS — SCALE BREAKERS — SHEAR
SCRAP BALLERS — CONTINUOUS PICKLING

WIRE MILL EQUIPMENT

PATENTING, GALVANIZING AND TINNING TAKE-UP FRAMES
WIRE FLATTENING MILLS — SPOOLERS
NAIL GALVANIZING AND BLUEING MACHINES
BARBED WIRE AND FIELD FENCE MACHINES

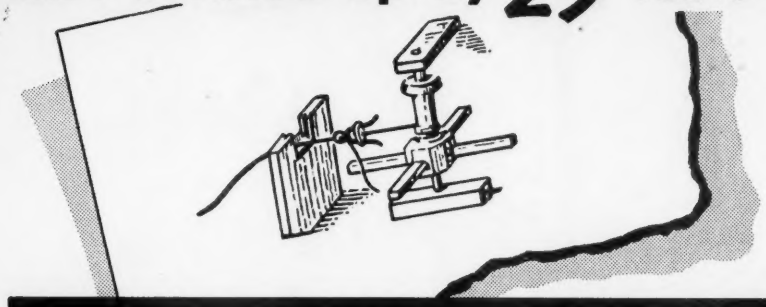
WEAN EQUIPMENT CORPORATION

CLEVELAND • OHIO



No. 1155
Field Fence
Machine

This die plate isn't backed up by 29 tests—



BUT THESE DIES ARE!

The die plate on this sixteenth-century wire-drawing contrivance *wasn't* backed by twenty-nine tests—quality-insurance—

But your dies of Carboloy Cemented Carbide are!

Every year Carboloy spends thousands of dollars on testing and improving the quality of the dies you use. You should see all the tests for purity and performance they have to pass!

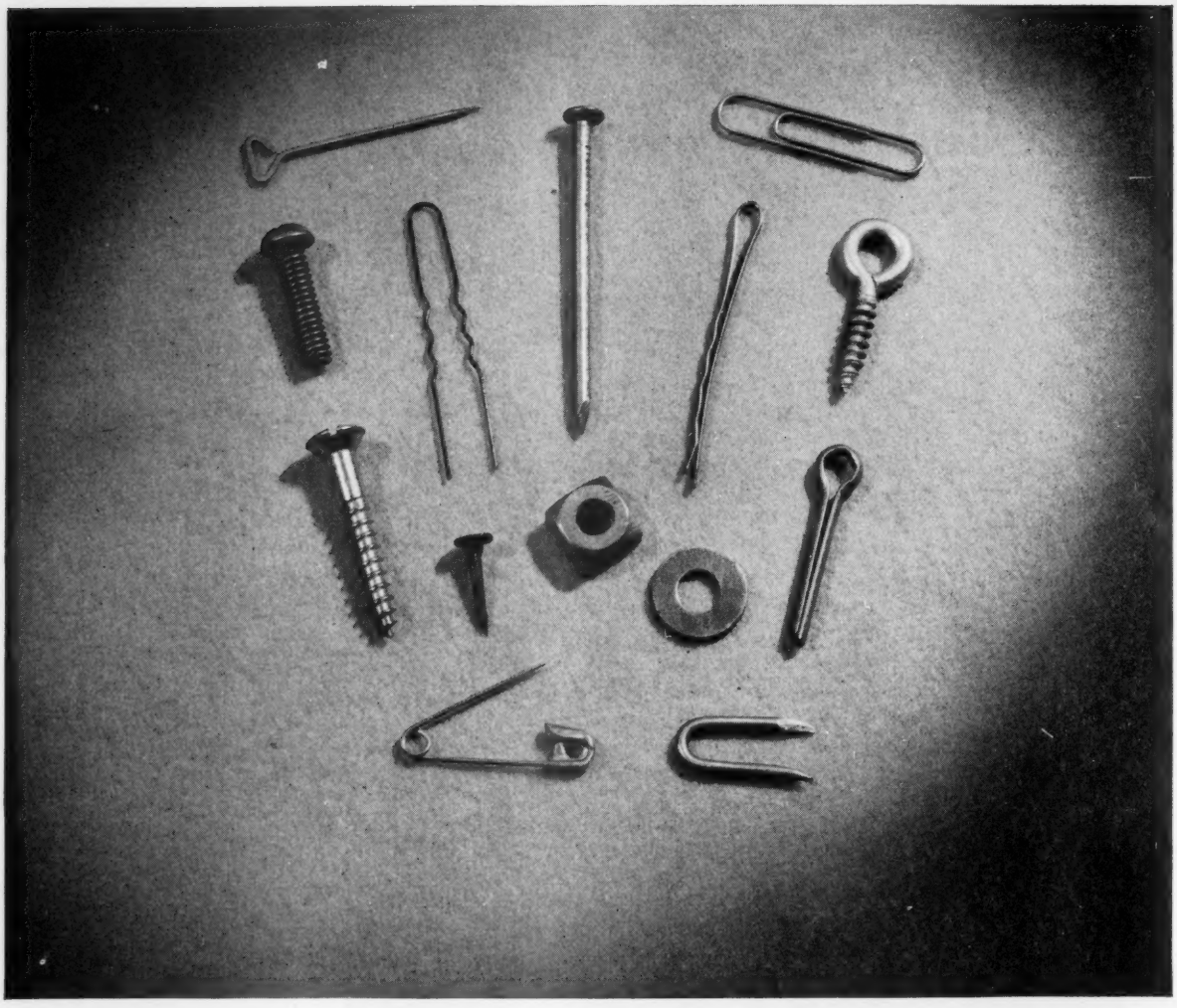
This is just one of the twenty-nine tests, from powder to finished product, that Carboloy Cemented Carbide dies undergo before final release. It is a photo-micrographic examination for checking the micro-structure of the cemented carbide, which must meet Carboloy's exacting specifications.

That's why you can be so sure of quality performance from Carboloy wire-, tube- and bar-drawing products. Let us tell you more about these dies—and about Carboloy's extra benefits and assurances of quality. And ask for the Carboloy DIE SERVICE MANUAL D-119, best of its kind.

CARBOLOY COMPANY, INC., 11171 E. 8 MILE BLVD., DETROIT 32, MICHIGAN

CARBOLOY®

CEMENTED CARBIDE



Things we cannot do without

We'd have a hard time getting along without these familiar pins and clips and bolts and screws. In different ways each of these items makes practical use of the advantages of steel wire . . . economy, strength, ease of manufacture, adaptability to coating and plating, wide range of physical and mechanical properties, long life . . . to name but a few.

And because steel wire has so many uses, there are virtually thousands of different kinds of it—each best suited to make some particular product better or more economical. We specialize in the production of high-quality steel wires in our modern mills located at Sparrows Point, Maryland, and Johnstown, Pennsylvania.

We take pride in meeting our customers' wire needs exactly, whether for a few tons or a dozen carloads. And looking to the future, we welcome your invitation to help you develop better wire products.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

★ **BETHLEHEM WIRE** ★ BETHLEHEM STEEL ★

WIRE & WIRE PRODUCTS, Vol. 24, No. 1, January, 1949. Publication Office, at One Sherman Ave., Jersey City 7, N. J. Executive Office, 300 Main Street, Stamford, Conn. Published monthly by the Quinn-Brown Publishing Corp., Richard E. Brown, President; R. S. Spengel, Secy. and Treas. Subscription price: U. S. $5.00; Canada, $5.00 per year; 50 cents per copy; Foreign, $7.50 per year. Re-entry as second class matter in Jersey City Post Office pending.

here's the

NEW PROTECTIVE COATING

for live wires

MARVINOL VR-10, the versatile vinyl resin, offers superior stability in protective coatings from raincoats to jackets and coatings for wire. Here are some of the advantages it offers you . . .

MORE STABILITY . . . In processing and in end products, Marvinol offers you greater stability . . . superior resistance to heat, light, oils, acids, aging, wear and other normally destructive forces . . . better low temperature characteristics. High molecular weight gives Marvinol coats and jackets extra toughness and "dryness."

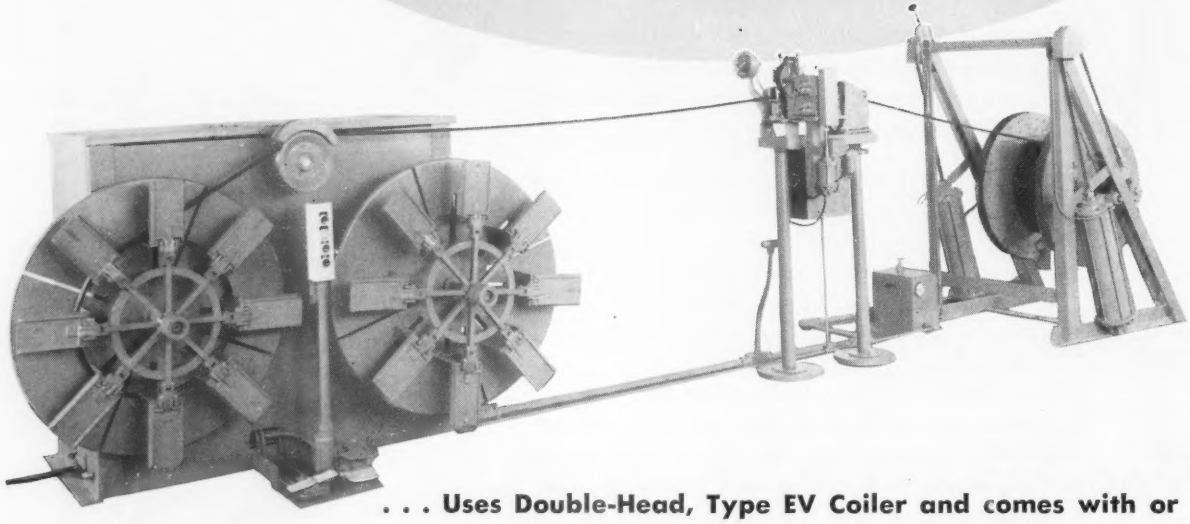
MORE PROCESSING ADVANTAGES . . . Production runs prove that Marvinol gives shorter premix and Banbury cycles plus faster extrusion rates. These are important savings whether you are calendering, extruding or molding. Wire coatings made from Marvinol may be brilliantly or delicately colored . . . are easily cleaned.

MORE UNIFORMITY . . . Marvinol resins are a development of Martin research and Martin's quarter-century of plastics experience. Produced in the world's most modern chemical plant, they assure unexcelled uniformity. The Glenn L. Martin Company does not compound or fabricate in the plastics field. If you make or coat wire, our sales engineers and customer service laboratory offer full technical cooperation. If you buy or use finished wire, write to Chemicals Division, Dept. W-1, The Glenn L. Martin Company, Baltimore 3, Maryland.

Martin ® Marvinol

RESINS, PLASTICIZERS AND STABILIZERS PRODUCED BY THE CHEMICALS DIVISION OF
THE GLENN L. MARTIN COMPANY • AN INTERNATIONAL INSTITUTION
"BETTER PRODUCTS, GREATER PROGRESS, ARE MADE BY MARTIN."

HEAVY-DUTY COILING & MEASURING EQUIPMENT



. . . Uses Double-Head, Type EV Coiler and comes with or without JLE Spark-Testing Equipment. For coiling heavy insulated wire, bare wire, rope or strand.

ANOTHER JLE CONTRIBUTION TO PROGRESS IN THE WIRE INDUSTRY!

Full details including quotations on request.

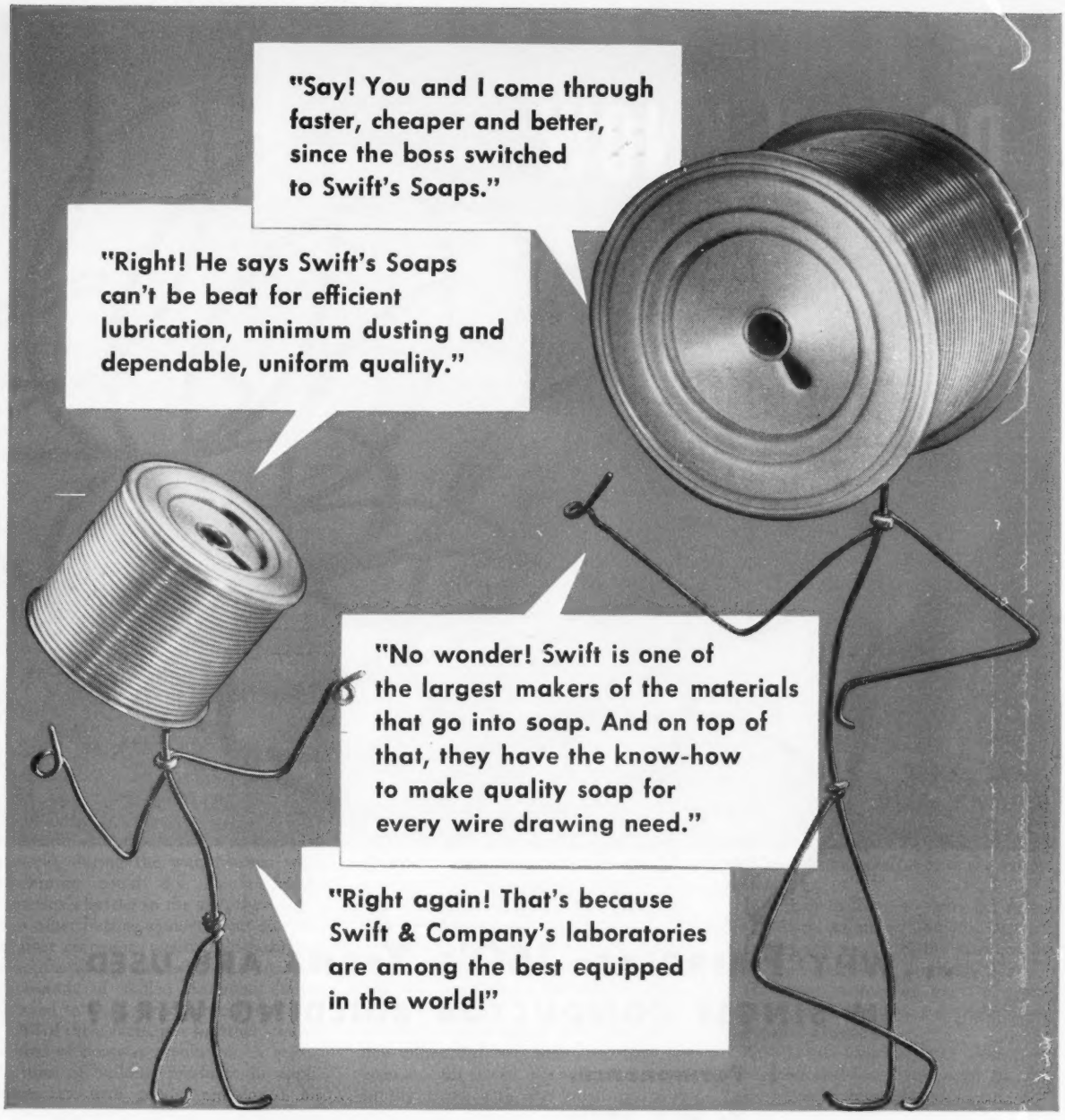
JAMES L. ENTWISTLE CO.

43 CHURCH STREET, PAWTUCKET, RHODE ISLAND

30 YEARS OF SERVICE TO THE WIRE INDUSTRY

Canadian Representatives:
THE A. R. WILLIAMS MACH. CO., LTD.
64 FRONT ST. W.
TORONTO, ONT.

British Associates:
GENERAL ENGINEERING CO., LTD.,
BURY ROAD, RADCLIFFE,
LANCS., ENGLAND


"Say! You and I come through faster, cheaper and better, since the boss switched to Swift's Soaps."
"Right! He says Swift's Soaps can't be beat for efficient lubrication, minimum dusting and dependable, uniform quality."
"No wonder! Swift is one of the largest makers of the materials that go into soap. And on top of that, they have the know-how to make quality soap for every wire drawing need."
"Right again! That's because Swift & Company's laboratories are among the best equipped in the world!"

There's a Swift Distribution Point *near you* . . . to give you fast, efficient service. Call on Swift for

Swift's Soaps

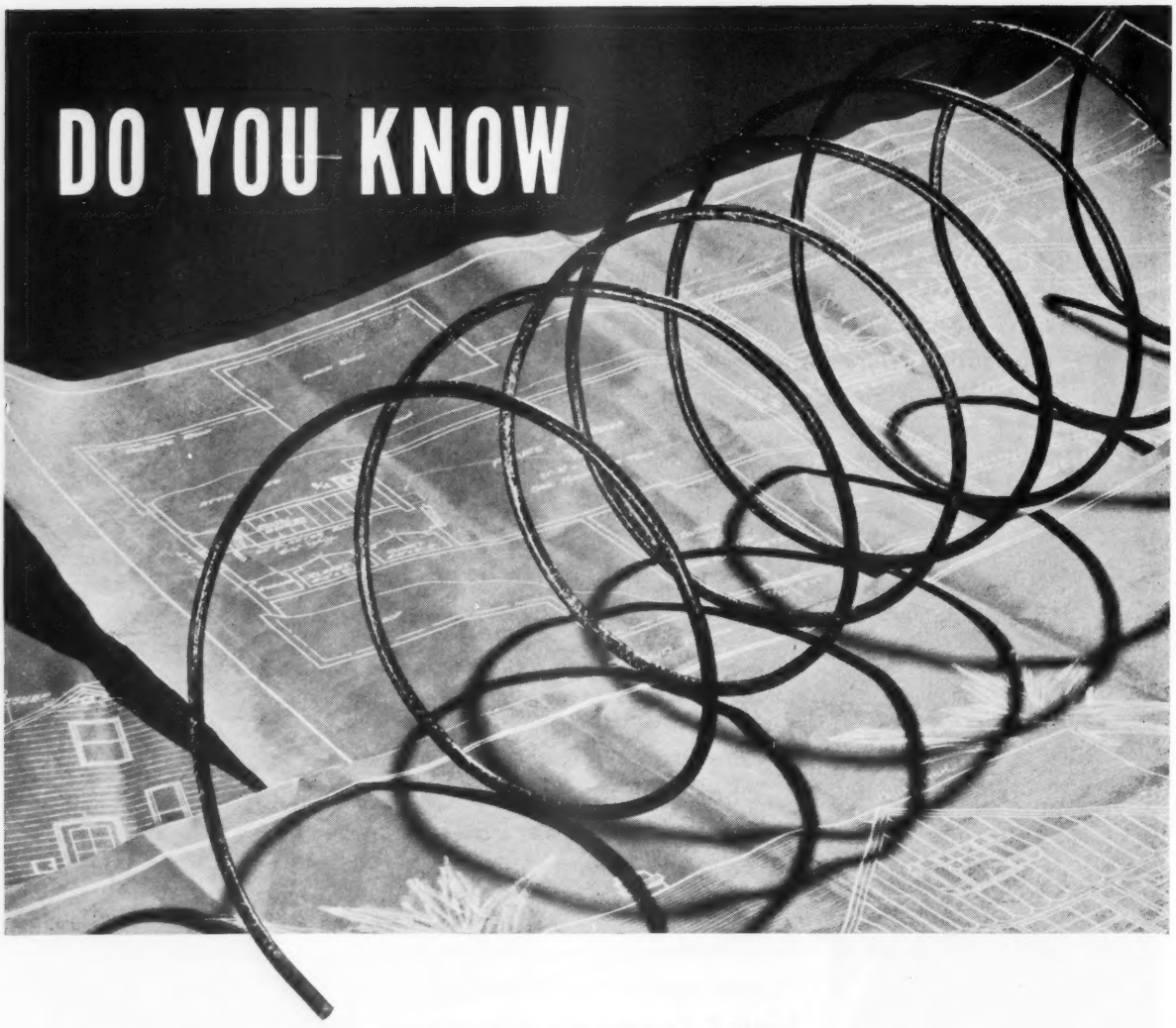
for every wire drawing operation

Powdered White Ribbon
Guaranteed Powder
Snap Heavy Duty
Wire Drawing Powder No. 282
No. 559 Powdered Soap

In drums and bags

Swift & Company

Soap Department, Chicago 9, Illinois



...WHY FIBERGLAS* 150's YARNS ARE USED IN SINGLE CONDUCTOR BUILDING WIRE?

1. **Permanence.**
2. **Low Cost.**
3. **Good Yarn Application Efficiency.**
4. **Better Space Factor.**

For complete information about Fiberglas Yarns, for this and other electrical uses, write Owens-Corning Fiberglas Corporation, Dept. 875, Toledo 1, Ohio. Branches in principal cities.

In Canada: Fiberglas Canada Ltd., Toronto, Ontario

OWENS-CORNING
FIBERGLAS
T.M. REG. U.S. PAT. OFF.
Yarns

***FIBERGLAS is the trade-mark (Reg.U.S.Pat.Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.**

If this customer could get all the Aluminum wire he wants...

HE: ***My customers know aluminum's advantages and will want my Alcoa Aluminum wire products...***

WE: ***That's why saying NO is so tough...***

There is no mystery in the reasons.

We have talked aluminum, aluminum, aluminum, for sixty years.

Manufacturers, and Americans in general, during the war, learned what aluminum could do. As it fought America's battles in the sky, they saw it win other battles against great stresses, against corrosion, against old-fashioned manufacturing methods. Hundreds of thousands of skilled American hands learned to work with aluminum . . .

All of these facts, put together, caused a kind of postwar revolution. A manufacturer of building products, or appliances, or wire goods, redesigned his line to take advantage of aluminum's usefulness. *Suddenly, thousands of such manufacturers were clamoring for aluminum!*

So many that—with aluminum as with countless other products—the world demand exceeded the supply. And America's new aircraft program subtracts its large and necessary share.

That is why, right at this enthusiastic moment, events force us to learn to say NO. We must say a flat NO to those who want aluminum because they can't get their regular metal. A milder NO to new aluminum users with ideas that are economically sound. We will endeavor to supply them with the small amounts needed for experimental use. Very drastic NO's to many of our own fabricating plants, which, for some time, we have operated at only a fraction of their capacity.

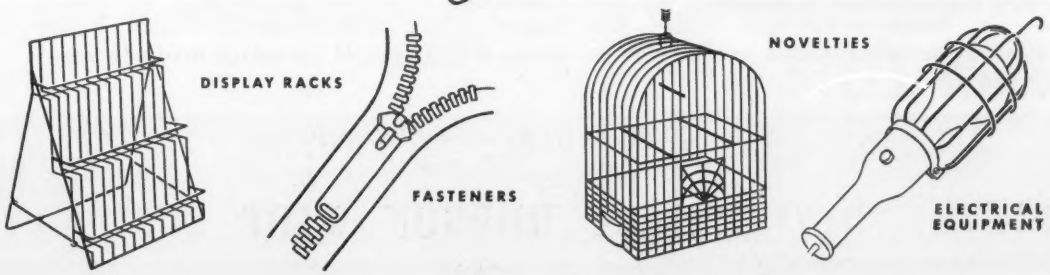
Every time we have to say NO to a customer, it will be the fairest NO we know. Our first obligation is, of course, to the host of old customers who have put all their eggs in the aluminum basket.

But there will be no light decisions. Your Alcoa salesman and his District Manager will work out the answers, as a team whose guiding motive is this:

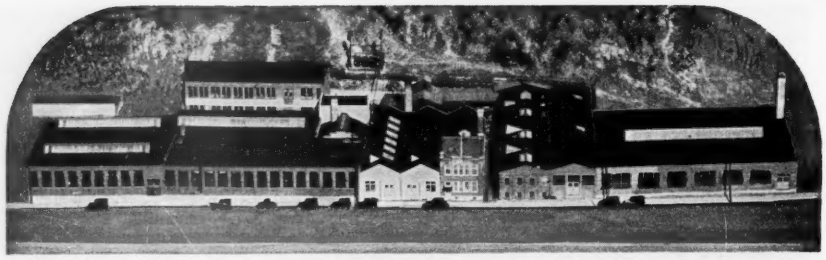
We want more and more of your business, as soon as we can make more aluminum available.

ALUMINUM COMPANY OF AMERICA, 1828 Gulf Building, Pittsburgh 19, Pa. Sales offices in principal cities.

ALCOA *first in Aluminum*



HUDCO



HUDSON WIRE CO. PLANT AT OSSINING, N. Y.

This plant is one of the most up-to-date and completely equipped plants in the world for the production of "HUDCO" fine wires in all metals.

ESTABLISHED IN 1902

HUDCO

WIRES FOR METAL SPRAYING

Pure lead, Lead Alloy, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire. High Conductivity, Electric Wire. Cadmium, Nickel Silver, Aluminum, Monel Metal, Prosphor Bronze,. Pure Nickel, Commercial Bronze, Brush Wires, Crimp and Straight, Brass, Steel, Nickel Silver, Copper and Prosphor Bronze.

HUDCO

FINE BARE WIRES

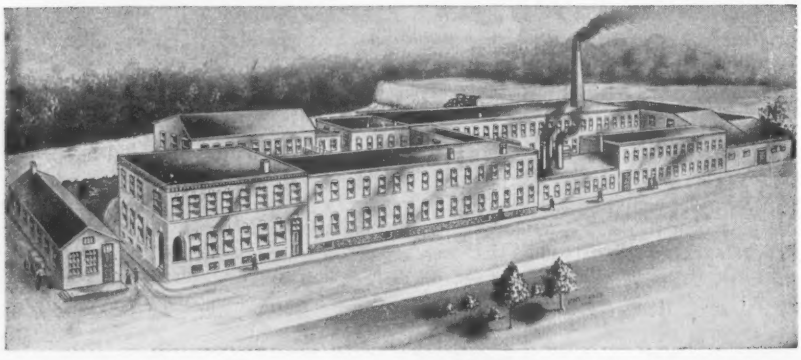
High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper. Cadmium, Nickel Silver Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specifications, Metallic Fibre for Packing Purposes, Copper Bronze, Zinc, Lead and Aluminum.

"HUDCO" specially processed Copper Wire for enamelling purposes is drawn from selected Copper, insuring the maximum conductivity. This is but one example of the use of the most advanced and approved materials and methods in our processing.

BETTER WIRE AT LOWER COST

Send Us Your Specifications and Let Us Quote Prices

HUDSON WIRE COMPANY • OSSINING, N. Y.



Winsted Division of HUDSON WIRE CO. at Winsted, Conn., modern and completely equipped enamelled wire plant for LEAKPROOF ENAMELLED WIRE and all standard and special coverings.

WINCO

"WINCO" enamelled wire is drawn from special selected copper, assuring perfect enamelling. All wire tested before shipment.

"WINCO" enamelled wire is available in all standard and special coverings made to meet exacting requirements.

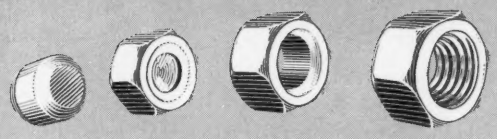
Samples of LEAKPROOF and other enamelled wires sent on request

WINSTED DIVISION OF HUDSON WIRE COMPANY

WINSTED, CONN.

Scrapless Nut Wire

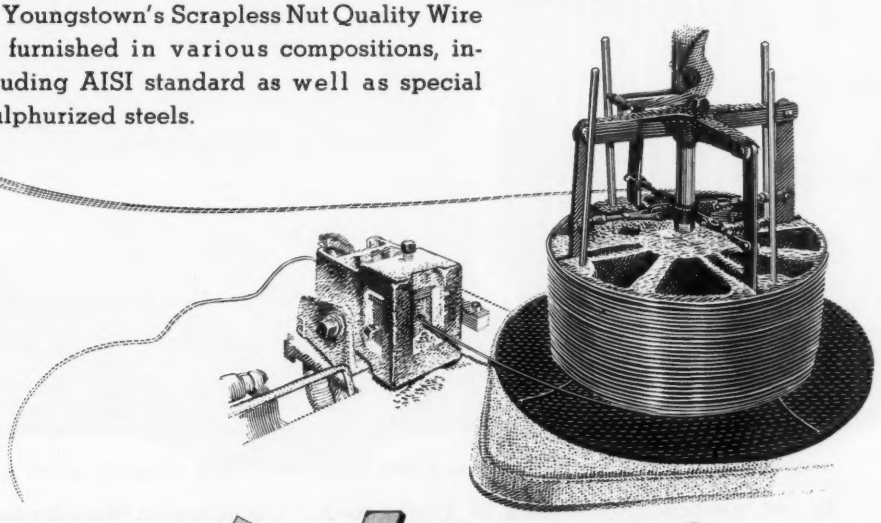
custom built to meet customers' requirements



SCRAPLESS Nut Quality Wire is not an ordinary steel for common applications. It is a custom built product designed to meet customers' specific requirements for cold heading, cold punching, cold expanding and threading, in the production of a variety of nut shapes on continuous heading machines.

Every step of its manufacture is carefully controlled--from the melting furnaces to the final drawing operation on the wire machines. Each coil of wire is subjected to close inspection and rigid tests with modern electrical testing apparatus.

Youngstown's Scrapless Nut Quality Wire is furnished in various compositions, including AISI standard as well as special sulphurized steels.



QUALITY YOUNGSTOWN SERVICE

Youngstown STEEL WIRE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

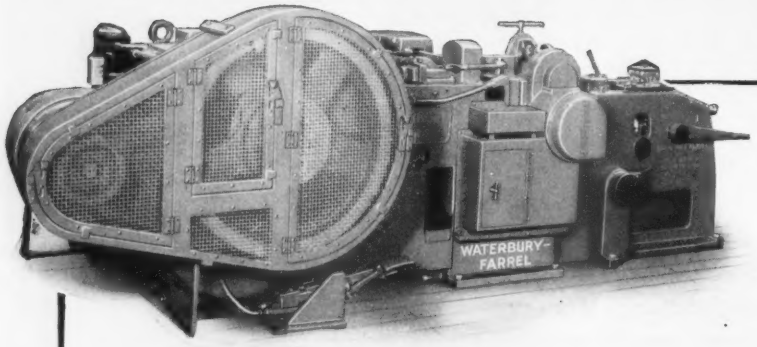
Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices — Youngstown 1, Ohio

Export Office - 500 Fifth Avenue, New York

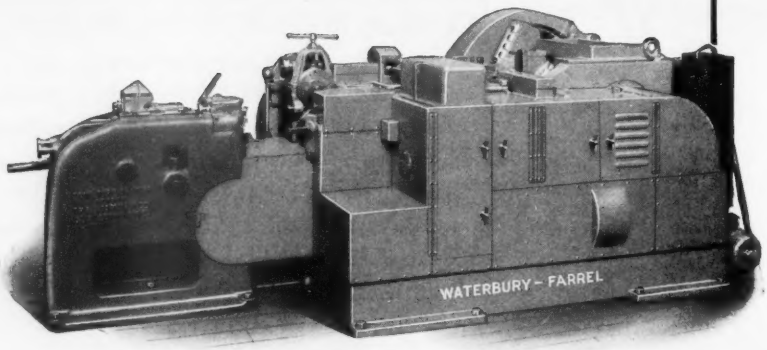
WIRE - COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES.

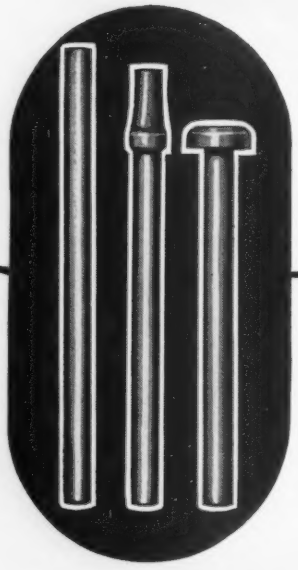
New WATERBURY "HI-PRO" HEADS 150 ($\frac{1}{4}$" × 3") BLANKS PER MINUTE From AJAX-HOGUE Drawn Wire



Waterbury "Hi-Pro" header with AJAX-HOGUE wire drawer attached.

Other side of same header showing AJAX-HOGUE drawer at left.

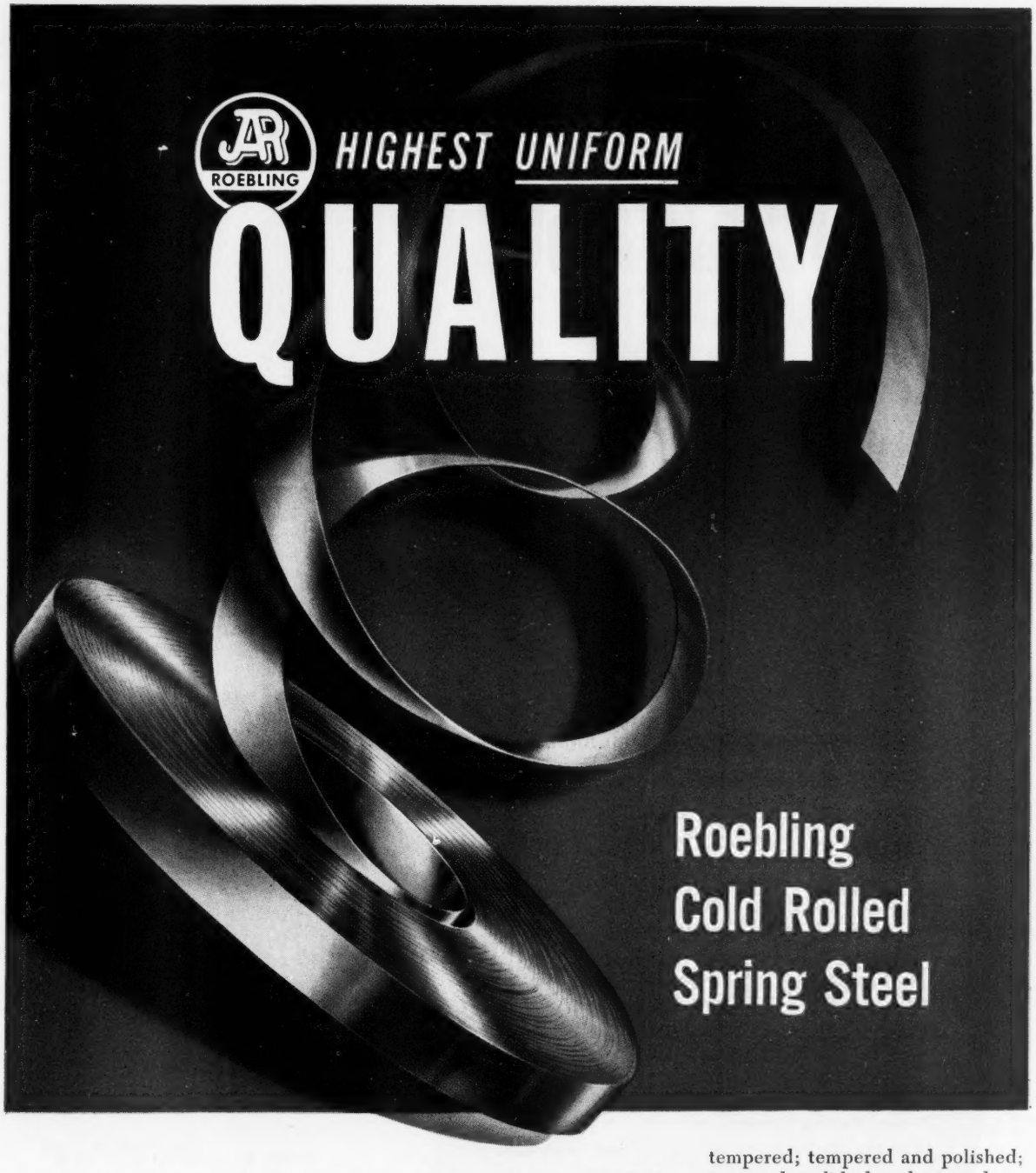




¼" x 3" blanks drawn and headed on the machines illustrated.

● The New Waterbury-Farrel Hi-Pro solid die, double stroke crank header achieves a new high in fast, uniform cold heading of blanks to 3 inches in length. A most important contributing factor to this exceptional performance is the Ajax-Hogue drawer which provides the header with freshly drawn, clean, straight wire of unvarying accuracy. Ajax-Hogue wire drawers are built in five sizes with capacity from ¼ inch to 1 inch diameter to be used with every make of cold header. Write for bulletin No. 111 for more complete information.

THE Ajax MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND 17, OHIO
110 S. DEARBORN ST. CHICAGO 3, ILLINOIS
DEWART BUILDING NEW LONDON, CONN.



EVERY INCH IDENTICAL IN GAUGE, GRAIN, FINISH

PRODUCTION SCHEDULES don't go out of kilter . . . you cut down stoppages and rejects when you use Roebling Cold Rolled Spring Steel! For this is a typically Roebling product . . . uniform in physical properties and structure; dimensionally accurate; faithful to the most exacting specifications.

With higher than 0.25% carbon content, Roebling Cold Rolled Spring Steel can be furnished annealed and hard rolled untempered in bright finish. In the higher carbons in this range, it can be furnished tempered, in scaleless tempered; tempered and polished; tempered, polished and strawed; or tempered, polished and blued.

Your Roebling Field Man will be glad to help you select the cold rolled spring steel; round, flat or shaped wire for genuinely superior service and utmost economy in your own products. John A. Roebling's Sons Company, Trenton 2, New Jersey.

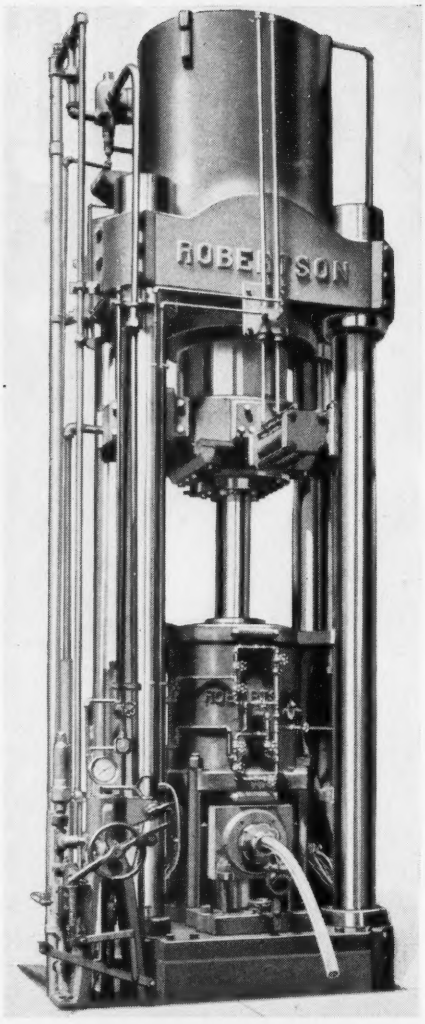
WRITE OR CALL THE ROEBLING FIELD MAN AT YOUR NEAREST ROEBLING OFFICE AND WAREHOUSE

Atlanta, 934 Avon Ave. ★ *Boston,* 51 Sleeper St. ★ *Chicago,* 5525 W. Roosevelt Rd. ★ *Cleveland,* 701 St. Clair Ave., N. E. ★ *Denver,* 1635 17th St. ★ *Houston,* 6216 Navigation Blvd. ★ *Los Angeles,* 216 S. Alameda St. ★ *New York,* 19 Rector St. ★ *Philadelphia,* 12 S. 12th St. ★ *Pittsburgh,* 855 W. North Ave. ★ *Portland, Ore.,* 1032 N. W. 14th Ave. ★ *San Francisco,* 1740 17th St. ★ *Seattle,* 900 First Ave.

ROEBLING

☆ *A CENTURY OF CONFIDENCE* ☆

LEAD ENCASING PRESS *by* ROBERTSON



UNIFORM STEADY OUTPUT!

Yes, and low operating and maintenance costs, too—because Robertson Lead Encasing Presses are practically "custom-built" to fit your specific requirements.

Our more than 89 years of specialized experience in the design and manufacture of high pressure hydraulic equipment is at your service to help you solve your lead encasing problems. Consult us.

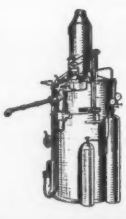
We also design and build Extrusion Presses, Hydraulic Pumps, Melting Furnaces and Pots, Dies and Cores, Lead Sheath Stripping Machines and Hydraulic Equipment for Special Uses. Write for details.

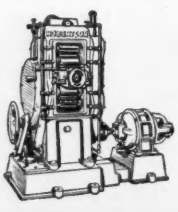
JOHN Robertson COMPANY INCORPORATED

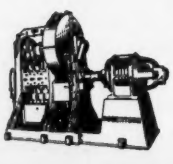
125-137 WATER STREET, BROOKLYN 1, NEW YORK

Designers and Builders of all Types of Lead Encasing Machinery

Since 1858

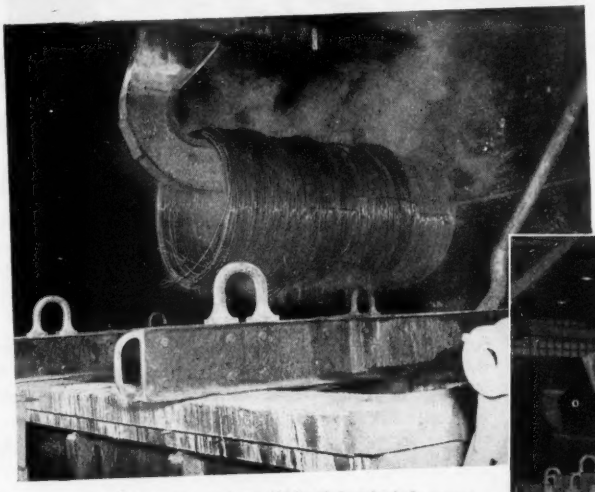




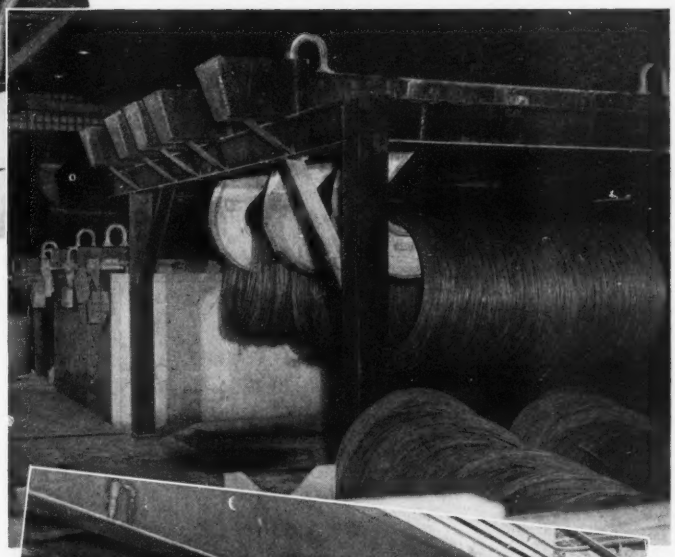


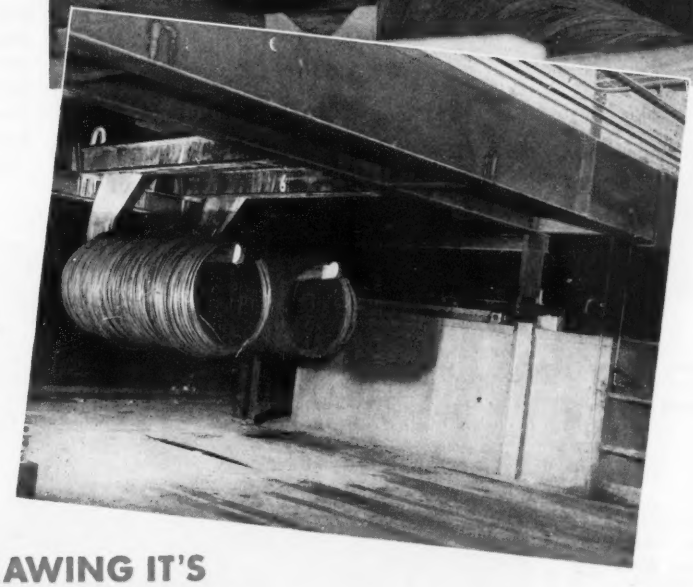
FROM DIP TO DRAW IN 20 MINUTES!

No Liming... No Baking



with MAGNUS METAL COAT #267





Photographs courtesy National-Standard Company.

Top—Rod emerging from Metal Coat solution. Will dry of its own heat.

Middle—Dry coated rod can be stored indefinitely without rusting.

Bottom—Coated rod ready for pick-up to drawing machines. Note clean floor.

- **Speedier Drawing**
- **Cleaner Finishes**
- **Longer Die Life**
- **Reduced Rejects**
- **Less Lubrication Costs**
- **No Rusting**
- **No Hydrogen Embrittlement**
- **No More Dust**

INVESTIGATE... If you're interested in better wire at lower costs.

IN WIRE DRAWING IT'S

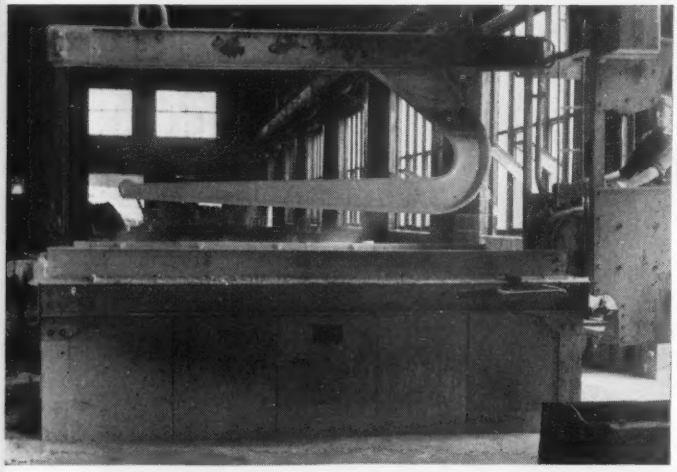
Magnus

CLEANERS • EQUIPMENT • METHODS

MAGNUS CHEMICAL COMPANY • 188 South Avenue, Garwood, N. J.

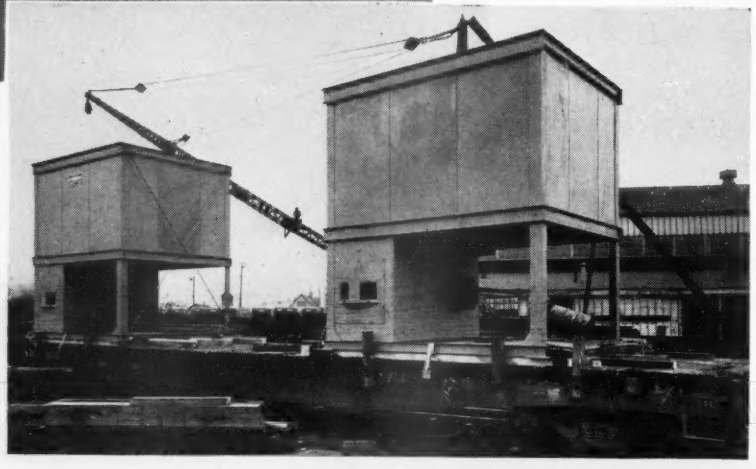
IN CANADA—MAGNUS CHEMICALS, LTD., 4040 RUE MASSON, MONTREAL 36, QUE.

SEVEN REASONS WHY You'll Profit by using the CARL-MAYER HI-SPEED REGISTERED ROD BAKER



Carl-Mayer Hi-Speed Rod Baker at Atlantic Wire Co.

Carl-Mayer Hi-Speed Rod Baker at Wickwire Spencer Steel Co.



Recent shipment of Carl-Mayer Hi-Speed Rod Bakers to large wire mill. Note compact heavy duty construction.

"CARL-MAYER" PATENTS (Rod Baker)

United States
2,296,361
2,323,828
2,235,559

Canada:
396,144
401,589

NO OTHER BAKER CAN COMPARE!

- HI-SPEED PRODUCTION. Bakes up to 4,000 # of rod per pin in 3 to 15 minutes, depending on whether high or low carbon, or up to 1,000 # fine wire in 15 minutes.
  Compare this with your present practice.
- Fuel Saving. Saves up to 40% over competitive designs due to patented self-opening and closing doors at top of baker and other features which greatly reduce heat loss.
- ELIMINATES RUSTING because of patented recirculating and blow-off system.
- SAVES SPACE. Production, as stated above, requires on the average of 150 square feet of floor space.
  Compare this with the obsolete truck type baker you may be using.
- LABOR SAVING (how essential.) Crane operator handles all operations — cleaning, lime coat and bake. *Compare this with the old conventional truck type* baker.
- THE LARGEST WIRE MILLS have recently chosen Carl-Mayer Rod Bakers for the preceding reasons. Can you afford not to?
- INITIAL COST. Ask for quotation and see how reasonable the cost for the results obtained. Carl-Mayer Rod Bakers can be furnished with direct or indirect heating and for any desired fuel.

THE IMPORTANCE OF RECENT PURCHASERS

is Proof of

CARL-MAYER OUTSTANDING QUALIFICATIONS.

Typical Users Include:

American Steel & Wire Co.
Allegheny Ludlum Steel Corp.
Atlantic Wire Co.
Atlas Steel Co.
Atlas Tack Corp.
California Wire Cloth Corp.
Comfort Spring Co.
Crucible Steel Co. of America
Eaton Manufacturing Co.
Frost Steel & Wire Co. Ltd.
Johnson & Nephew, Ltd.
Jones & Laughlin Steel Co.
Pittsburgh Tool Steel & Wire Co.
Republic Steel Corp.
Steel Co. of Canada
Wickwire Spencer Steel Div. of Colorado Fuel & Iron Corp.
Gary Screw & Bolt Co.

Backed by a Reliable Company with More Than 28 Years Experience

THE CARL-MAYER CORPORATION

3030 Euclid Avenue ◆ Cleveland, Ohio

Soaps and Compounds for...

BRASS & BRONZE

HIGH CARBON

COAT HANGER WIRE

LOW CARBON

COPPER

STAINLESS STEEL

SPRING WIRE

TOOL STEELS

DRY AND WET DRAWING OF FERROUS AND NON-FERROUS WIRE, TUBING, AND DEEP DRAWN PARTS

Our Engineers Will Be Glad to Cooperate With You in Finding the Most Economical and Efficient Solution to Your Drawing Problem.

Write or Telephone

R. H. MILLER CO., Inc.

HOMER,
New York

Established
1909

Product-Proved Wire . . .

PREFERRED BY

HUNDREDS OF MANUFACTURERS

CONTINENTAL STEEL CORP. STEEL CONTINENTAL REG. U.S. PAT. OFF. WIRE KOKOMO, IND.

Whether the need is for a rust-resistant wire that can stand up under difficult forming operations, or . . . for a shaped wire to provide a better-looking, longer-lasting trim for a particular product . . . manufacturers turn with confidence to Continental. More and more, manufacturers are depending on Continental wire to help them build better products. They know Continental wire is uniform in temper, uniform in coating, and that it is made to fit specific manufacturing and fabricating requirements.

Continental Chain Link Fence is used to enclose the properties of hundreds of industrial plants. It is the only fence made of KONIK, a patented steel containing copper, nickel and chromium to provide "clear through" resistance to rust and corrosion. When you need fencing for your property, insist on Continental Chain Link Fence. It will provide longer-lasting protection at lower cost per year of fence life. For further information write Continental at Kokomo, Indiana.

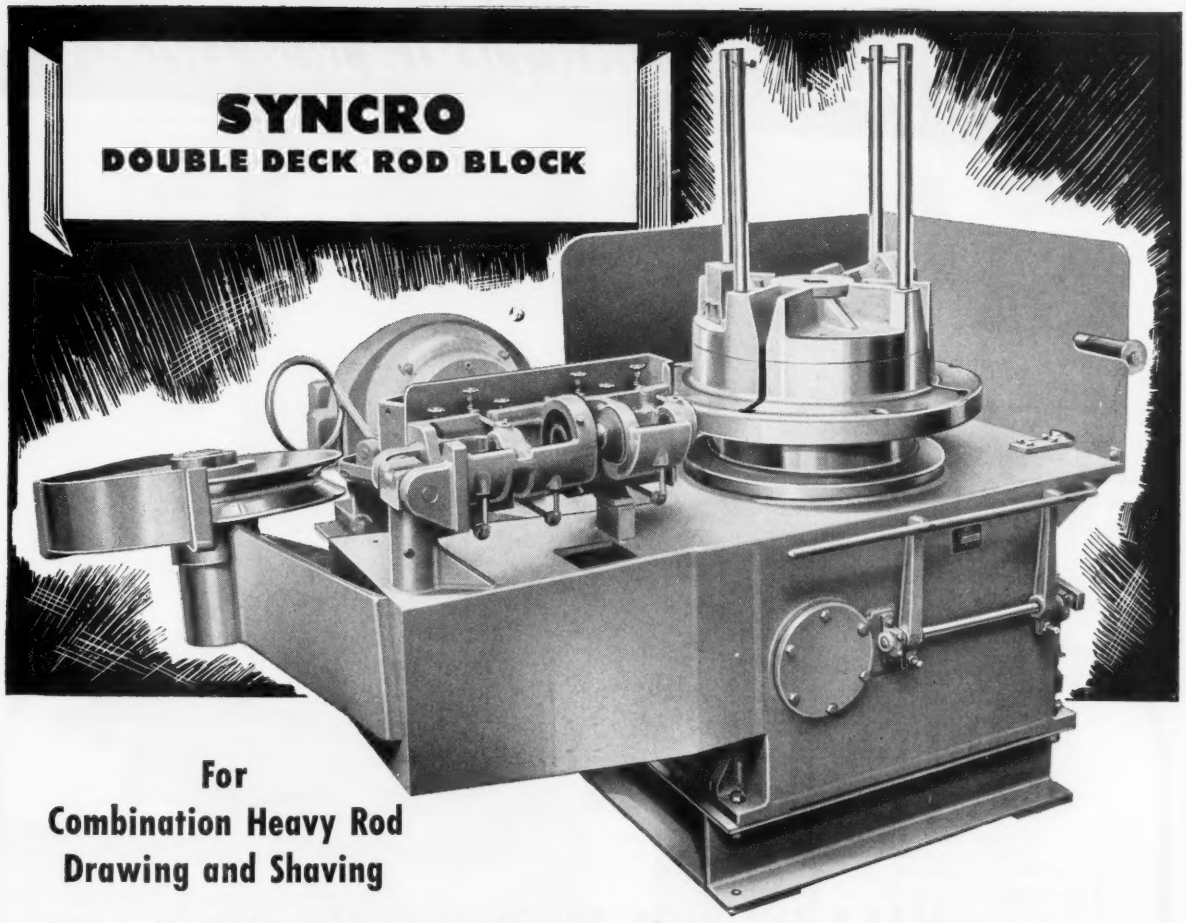
CONTINENTAL STEEL

CONTINENTAL STEEL CORPORATION

GENERAL OFFICES • KOKOMO, INDIANA

PRODUCERS OF *Manufacturer's Wire* in many sizes, shapes, tempers and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright, Lead Coated, and special wire. ALSO, Coated and Uncoated Steel Sheets, Nails, Continental Chain Link Fence, and other products.

SYNCRO
DOUBLE DECK ROD BLOCK



For Combination Heavy Rod Drawing and Shaving

Syncro adds another unit to their expertly engineered line of wire drawing equipment—*another important contribution to the industry.*

The New Syncro Double Deck Rod Block **can process non-ferrous rods as heavy as 1″ dia. Is designed to operate at highly efficient speeds with either A.C. or D.C. drives.**

Other Units Include

Wire Drawing Machines—Stranders, Closers, Cablers, Tapers, Juters—Compound Tanks—Capstan Sections—Pay Offs—Re-spoolers — Heavy Duty Take-ups — Coilers — Wire Covering Machines—Die Stringing Machines—Wire Rope Machines—Magnetic Slip Clutches—Pay-Off Reel Stands—Special Units

OTHER FEATURES

Stripper slots on upper block permit introduction of internal non-riding type stripper.

Companion take up can be furnished to allow reeling of finished product on reel sizes ranging up to 60″ flange dia. Your inquiry is invited regarding this or any of the other high quality wire drawing units in the Syncro family.

Machinery for the Wire Industry

1778

SYNCRO MACHINE COMPANY

611 Sayre Avenue **Perth Amboy, N. J.**

Affiliated Company

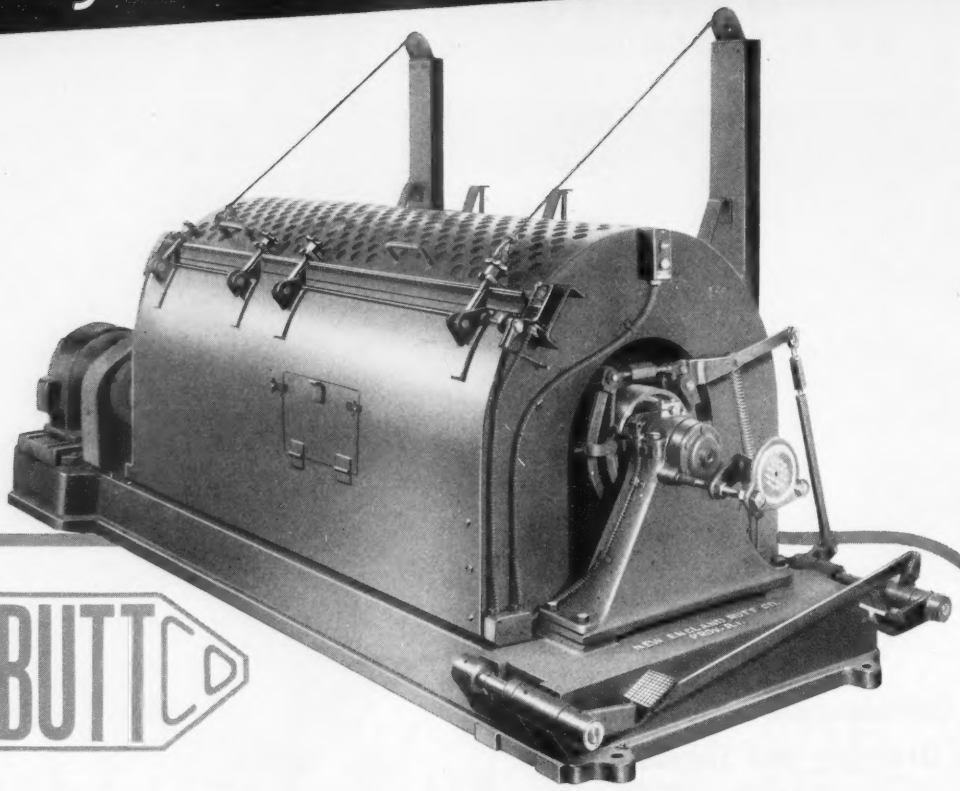
Winget-Syncro, Rochester, Kent, England

Standardize on **Syncro**

There's a standard Syncro machine for every wire drawing need, from rod to fine wire—from strands to cable.

SYNCRO

Give your Production a New Twist!



NE-BUTT CO

HERE'S THE HIGH SPEED BUNCHER FOR FAST, ECONOMICAL TWISTING OF SMALL WIRES

Check these big features:

- ☐ Two twists produced at each revolution
- ☐ Accommodates standard shop reels up to 24" dia. x 12¾" O.A. width
- ☐ Double drum grooved capstans
- ☐ Quick acting electrically operated brakes
- ☐ Push button control station
- ☐ Substantial guards and safety features
- ☐ Anti-friction bearings
- ☐ Rugged construction with low center of gravity

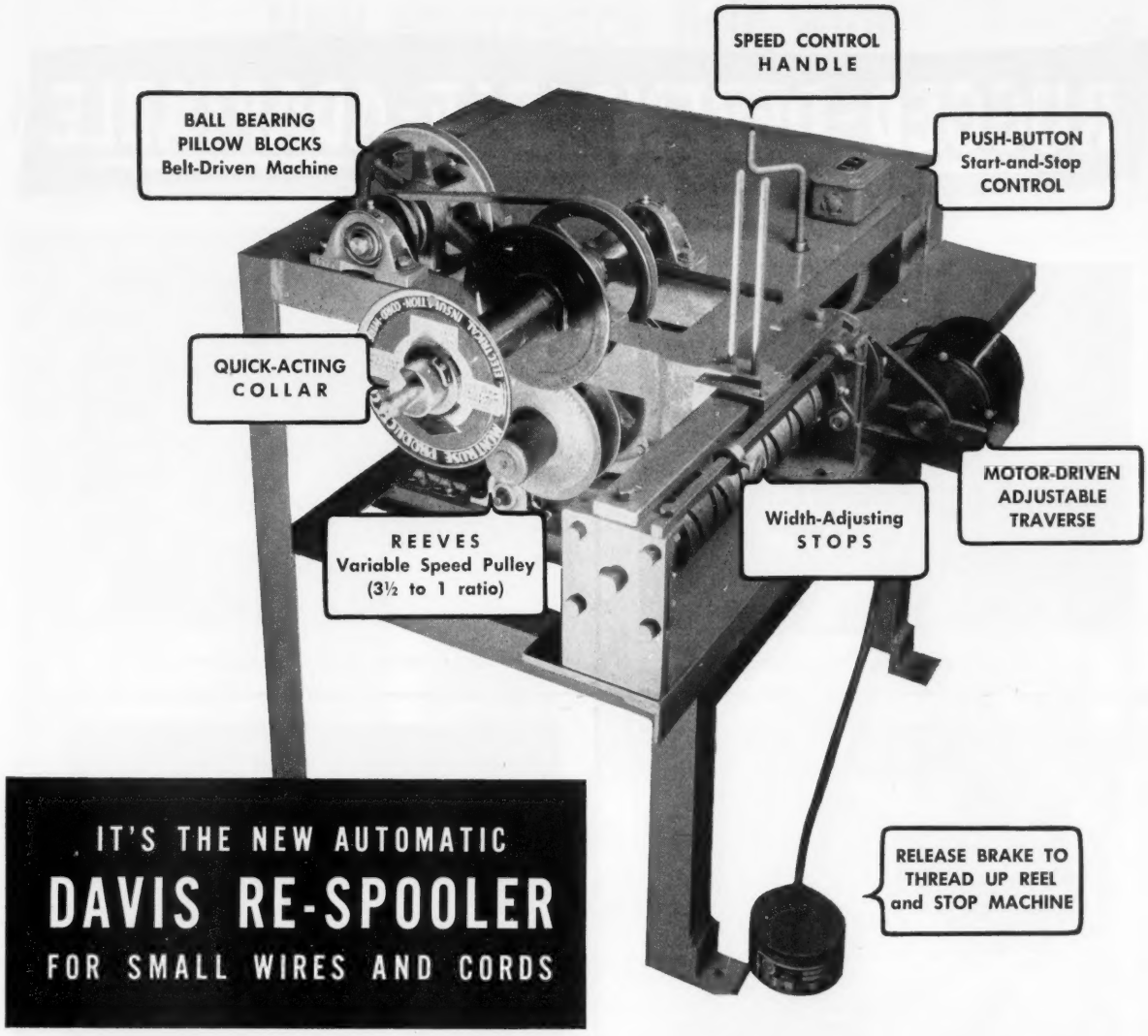
Butt High Speed Bunchers are made in two sizes: S-31 for strands up to No. 14; S-35 for strands up to No. 8. *For further details write for Circular No. 63.*

NEW ENGLAND BUTT COMPANY

Established 1842

304 PEARL STREET • PROVIDENCE 7, R. I., U. S. A.

JAMES DAY (MACHINERY) LTD., "FORD HOUSE", 88 REGENT ST., LONDON, W. 1, ENGLAND


SPEED CONTROL HANDLE
BALL BEARING PILLOW BLOCKS Belt-Driven Machine
PUSH-BUTTON Start-and-Stop CONTROL
QUICK-ACTING COLLAR
MOTOR-DRIVEN ADJUSTABLE TRAVERSE
Width-Adjusting STOPS
REEVES Variable Speed Pulley (3½ to 1 ratio)
RELEASE BRAKE TO THREAD UP REEL and STOP MACHINE

IT'S THE NEW AUTOMATIC

DAVIS RE-SPOOLER

FOR SMALL WIRES AND CORDS

- **Layer-winds parallel cord by adjusting spindle speed with the Reeves Drive and the Traverse running at constant speed!**
- **Automatic torque control starts machine at reduced torque to prevent breaking or stretching of wires!**
- **Used with pre-determined electrical counter, machine will stop automatically when required length is wound on reel. Allows one operator to run two machines!**
- **Equipped with Automatic brake control! Comes with cover guard for belt drive (not shown here)!**

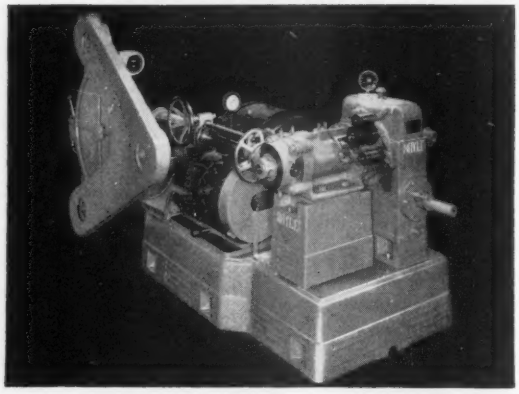
Write us today for detailed information . . .

DAVIS EQUIPMENT

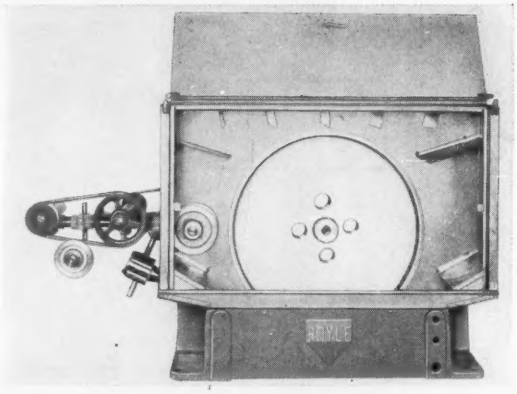
THE R. L. DAVIS ELECTRIC CO., INC. • WALLINGFORD, CONN.

SPARK TESTERS • SPOOLERS • TAKE-UPS • CAPSTANS

RUGGED-DEPENDABLE-ADAPTABLE

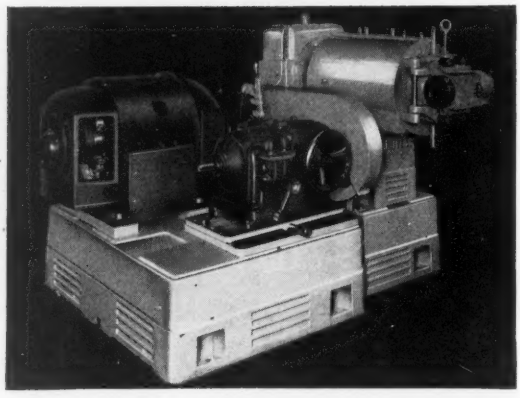


CONTINUOUS VULCANIZING MACHINE



36" CAPSTAN PLASTIC INSULATED WIRER

NUMBER 5 STRAINING MACHINE



No. 2. PLASTIC INSULATED WIRE MACHINE

ROYLE PRODUCTS

Continuous Extruding Machines for the Rubber, Plastic and Chemical Industries

Continuous Vulcanizing Machines for Rubber Insulated Wire

Plastic Insulated Wire Machines
Strainers
Cooling troughs
Light Wire and Cable Capstans
Motorized Take-Ups
Temperature Control Units

JOHN ROYLE & SONS

ROYLE
PATERSON
N. J.
1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

London, England
James Day (Machinery) Ltd.
REgent 2430

Home Office
E. B. Trout J. W. VanRiper
SHerwood 2-8262

Akron, Ohio
J. C. Clinefelter
JEfferson 3264

Los Angeles, Cal.
H. M. Royal, Inc.
LOgan 3261

PATERSON 3, NEW JERSEY

New emergency field wire has minimum diameter... maximum toughness

Wire manufactured by The Okonite Company, Passaic, New Jersey

HERE'S A NEW WIRE used by railroad companies for severe outdoor service on emergency communication installations. It's light in weight—easy to carry and rig. It's small in diameter—convenient to store. And it's tough enough to withstand constant dragging over rough terrain . . . in all kinds of weather. That's because the wire is insulated with Du Pont polythene and jacketed with Du Pont nylon.

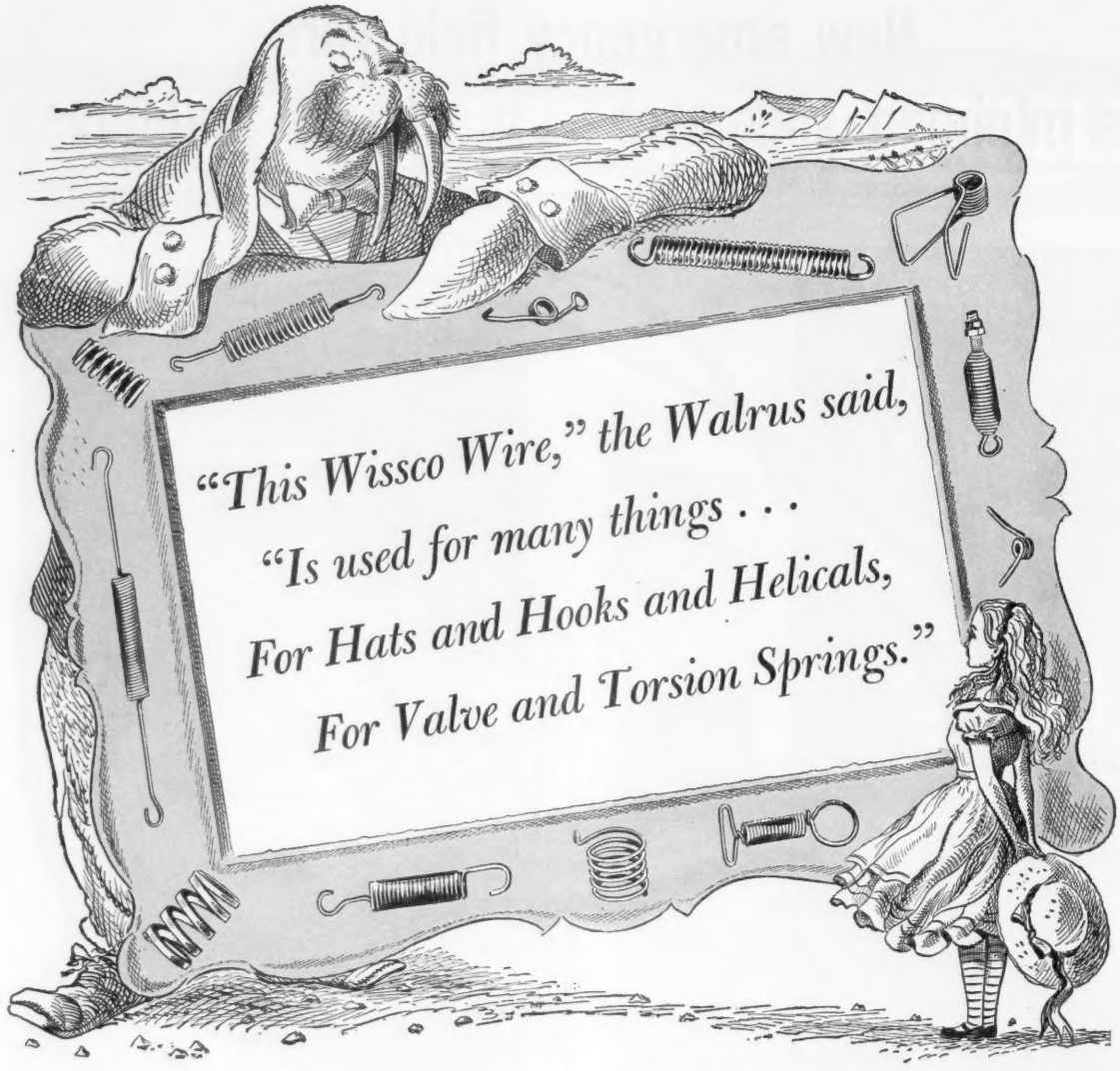
Since Du Pont polythene has such outstanding electrical properties, a thinner coating is needed to do a given job of insulation. It's flexible and resilient . . . resists many deteriorating influences that ruin ordinary insulation. The polythene is extruded directly on the twisted strands of copper wire.

To assure added protection against abrasion from jagged rocks and rubble, the insulation is covered with a thin extruded jacket of Du Pont nylon. For tough, durable nylon withstands strenuous wear. Greases, oils, most chemicals, high and low temperatures won't hurt it.

Perhaps nylon, polythene or another Du Pont plastic can help *you* make a better product. Both nylon and polythene can be readily molded or extruded. Before designing electrical parts or wires, look into their remarkable properties.

Write for free literature: E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Room 151, Arlington, New Jersey.

DU PONT
REG. U.S. PAT. OFF.
Plastics
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY



BECAUSE of its fine quality, Wissco Oil Tempered Wire is becoming the first choice of more and more manufacturers whose products require this type of wire.

Wissco Oil Tempered Wire is characterized by its uniformly high tensile strength, torsional value and fatigue life. It is supplied in a size range of from .010 to 9/16" in coils, diameters ranging from 8" to 6' and in cut lengths.

For this and scores of other steel specialty wires, call Wickwire Spencer. We can meet your needs for high or low carbon steel wire; round or shaped; in a wide variety of sizes, tempers, grades and finishes. And, if you have a wire problem, our metallurgists will be happy to help develop the type of wire that best meets your requirements. Send your wire questions to Wickwire Spencer.

WISSCO *Wire*

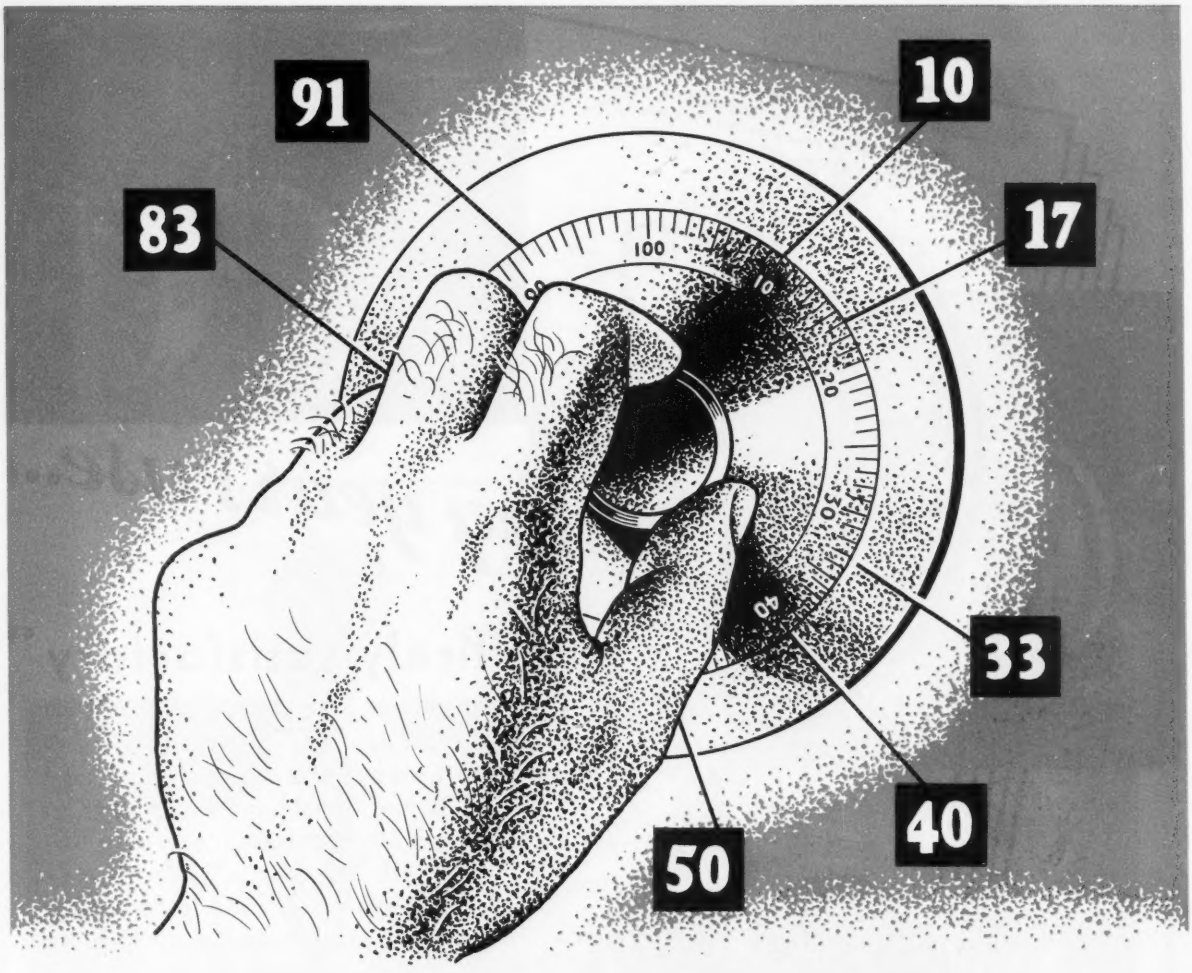
A PRODUCT OF WICKWIRE SPENCER STEEL DIVISION · THE COLORADO FUEL AND IRON CORPORATION

WIRE SALES OFFICE—361 DELAWARE AVE., BUFFALO 2, N. Y.

EXECUTIVE OFFICE—500 FIFTH AVE., NEW YORK 18, N.Y. · SALES OFFICES—BOSTON·CHICAGO·DENVER·NEW YORK

PACIFIC COAST SUBSIDIARY—THE CALIFORNIA WIRE CLOTH CORP., OAKLAND 6, CAL.

CF&I



WINNING COMBINATION for a *Happier* New Year

"There ought to be an easier way to make a living," say wire producers everywhere. For it must be admitted that wire men have more than their fair share of headaches.

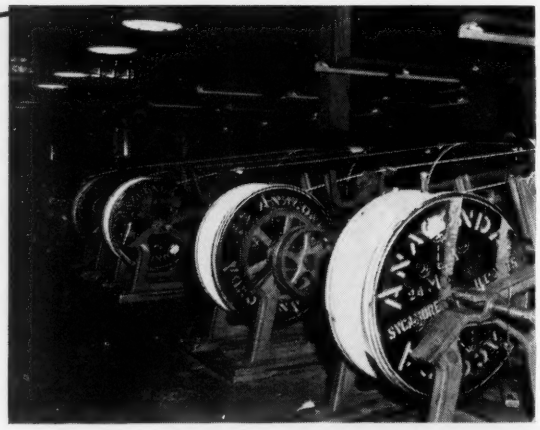
Now we're not going to tell you that *Standard* has the world's most wonderful "snake-oil" to cure all your headaches. (We wish we had!) But leading wire producers will tell you that a helluva lot of their problems have been solved with formulas perfected by *Standard*. For these special-purpose compounds are developed by experienced technicians to save you time, trouble and money!

So, for a *happier* new year, just sing out for *Standard!* There's a *Standard* service engineer always ready to serve you!

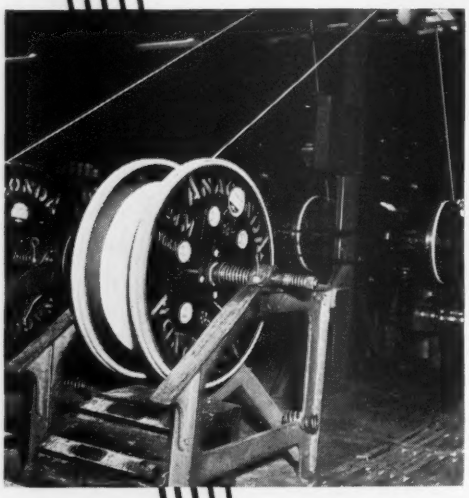
STANDARD'S WINNING COMBINATIONS #10-17 for galvanized and other wet wire drawing; #33 for extra bright finish on 1 and 2 hole wire; #40 for general wire drawing; #50 for hard finish on spring wire; #83 for cold heading; #91 for regular wire finish, nails or rod breakdown on high or low carbon.

wire drawing lubricants **Standard** INDUSTRIAL COMPOUNDS CO., INC.

4600 WEST FERDINAND STREET
CHICAGO 44, ILLINOIS



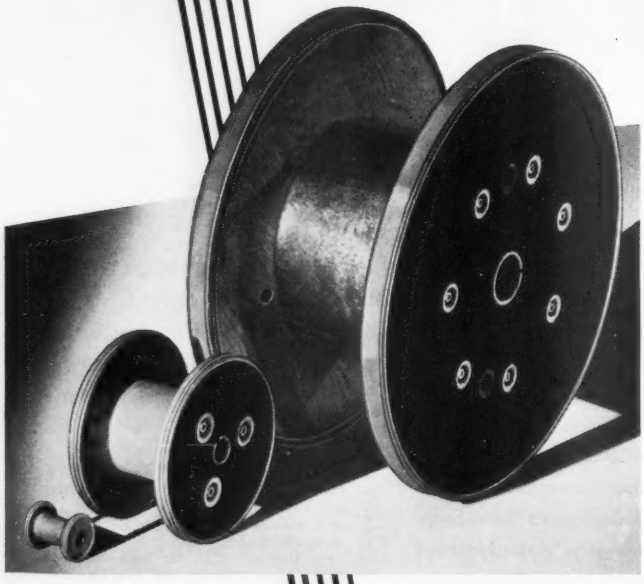
Right and Below: Hubbard 24" x 6" Metal Bound Reels in the Magnet Wire Department of the Anaconda Wire & Cable Company, Sycamore, Illinois.



"Many years use...

....entirely satisfactory"

The highly satisfactory service that these Hubbard Reels give Anaconda Wire & Cable Company is typical. Hubbard Metal Bound Spools and Reels have an industry-wide reputation for long-life. Normal "life-expectancy" is high even under the most severe conditions because of exceptionally sturdy construction. Woods for the flanges are selected for toughness and thoroughly seasoned. Steel rims, or "tires", give added stability and prevent chipping or splintering of edges. Make Hubbard your dependable source of supply for all types and sizes of spools, reels and traverses for manufacturing, shipping, and storing of wire. Standard types and sizes numbering in the thousands assure you of quality at minimum cost. Write for quotation on price and delivery.



HUBBARD SPOOL COMPANY
1624 Carroll Avenue • Chicago 12, Illinois

Hubbard

STEEL SPOOLS AND REELS . . . METAL BOUND SPOOLS AND REELS . . . STEEL TRAVERSES LIGHT WEIGHT REELS . . . WOOD REELS

There is no such thing as an UNIVERSAL LUBRICANT!

WE WOULD RATHER DO THIS

BUT

Actually we have to do this . . . .

A comprehensive analysis must be made to determine the one 'exactly right' compound for each job requirement.

Working in close alliance with the wire drawing field for many years, APEX is well equipped and qualified to serve you.

Kleen-Kote
Pic-Kleen
Lubra-Kote
WD-25
SP-2 Soap Powder
WDO

"SS" Drawing Oil
WD-12 & WD-16
"48" Series
D-31
201 & 205
WS-104

Write for your FREE COPY—"FORMULA FOR DETERMINATION OF PER CENT REDUCTION PER DRAFT FOR VARIOUS TOTAL REDUCTIONS".

Apex Alkali Products Co.

MAIN & RECTOR STS., PHILADELPHIA 27, PA. • PHONE: IVyridge 3-3939

Your G-E CABLE TAPE

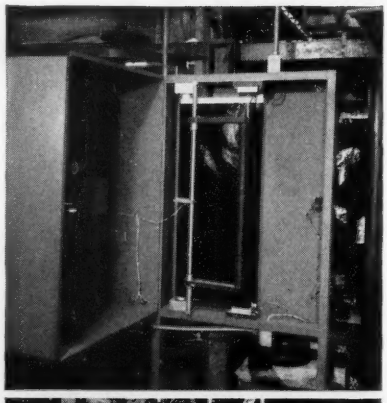
IS "DIELECTRICALLY" CONTROLLED

• One of the most important of the many quality-control tests made on all G-E cable tapes is the continuous testing for dielectric strength and possible faults in the cloth during manufacture. Pictured here is the equipment used in this control operation.

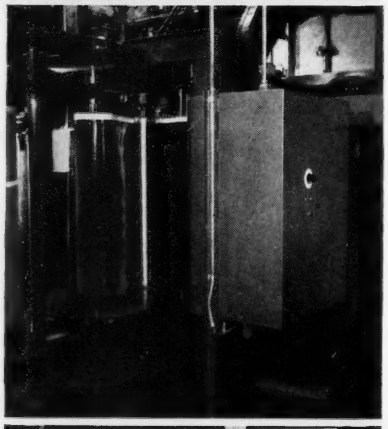
• Modern G-E control laboratories also test each lot of cable tape for tensile strength, tearing strength and resistance to heat and weathering .... all qualities which are vital in a top-quality cable insulation.

For further details write to Section 28-1, Plastics Division, Chemical Department, General Electric Company, Schenectady 5, N. Y.

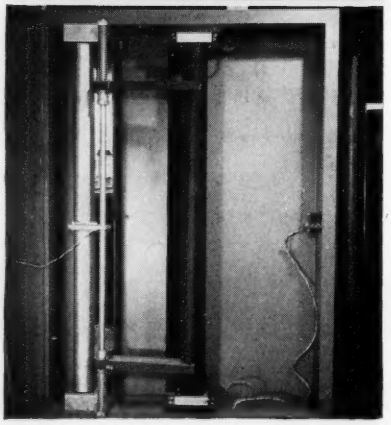
GE CABLE TAPE



An inner view of the Fault Detector, showing the varnished cloth passing between two electrodes which subject the material to a constant voltage, quickly spotting faults and weak points in the cloth.



View of the Fault Detector, showing the varnished cloth as it passes through the equipment, emerging from the rear to be wound on wooden cores prior to being cut into tape.



A close-up view of the interior of the Fault Detector, showing the elements of the device through which passes the varnished cloth as it comes from the curing ovens. Rubber rollers guide the cloth through the electrodes, making sure that every square inch of the cloth is thoroughly tested.

GENERAL ELECTRIC

CD49-01

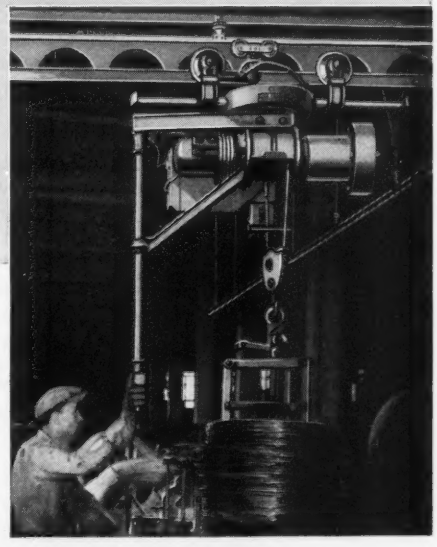
SPEED PRODUCTION *with*

Easy Operating

BLOCK-STRIPPING HOIST CARRIERS

Smooth operating Cleveland Tramrail block-stripping hoist carriers have been especially designed for this service and are serving many mills in the United States and Canada.

Safe, easy to operate, the equipment permits a man to take care of more blocks and draw heavier bundles. Older men can keep pace with younger men when Cleveland Tramrail block-stripping hoist carriers are provided.



• Electric hoist, push-button operated. Hand-propelled carrier with convenient rigid arm. Serves internal and external stripping.

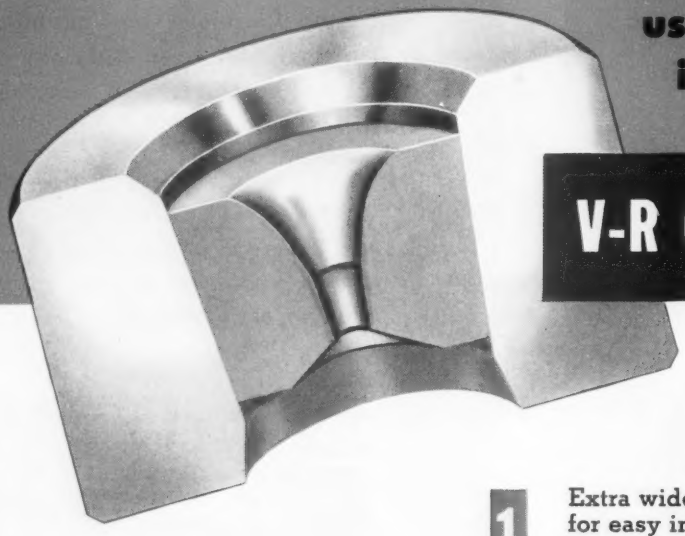
GET THIS BOOK!
BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
9204 EAST 288th STREET, WICKLIFFE, OHIO

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

PROFIT TALKS!

and it talks loud to users of carbide dies in industry . . .



V-R CARBIDE DIES

Incorporating FOUR of the most outstanding carbide die developments in drawing die history, V-R Carbide dies assure you of increased profitable production.

Profitable drawing operations are determined by the quality of the carbide dies you are using.

For those severe, high volume production jobs, call on V-R because only V-R Carbide dies contain all these exclusive features:

● Carbide die developments originating from the demands in your shop, are a standard feature in every V-R Carbide Die.

1. Extra wide tapered front and back openings for easy inspection and simple maintenance. Remember, NO steel to cut on resizing or refinishing operations on V-R dies.

2. Exclusive tapered nib design provides tremendous internal nib strength. Perfect concentricity of nib is your assurance of on-tolerance production.

3. Preformed rough cored back relief, built right into your V-R die eliminates costly die room coring operations over the entire range of hole sizes.

4. Of special interest to die users are the V-R Carbide dies now being furnished, rough cored to finish, at hole sizes below .015". These rough cored dies are available in dies sizes R-0, R-1, R-2, and R-3, rough cored at .004" and .010".

District Sales and Service in Principal Cities

V-R CARBIDE and TANTUNG

WAUKEGAN • ILLINOIS

vascoloy-ramet corporation

An affiliate of The Fansteel Metallurgical Corporation and The Vanadium Alloys Steel Company

The Wire Outlook

The national income in the year just ended surpassed all previous records—$240,000,000,000. Continued high demand for goods, although it tapered off toward the end of the year for some products, is likely to continue through 1949, any slackening in demand for consumer goods being offset by increased Government expenditures.

Appliance sales in some parts of the country, particularly the Midwest, have shown a decline, which is reflected in the wire industry in a decline in the demand for some types of electric wire, notably magnet wire. In December many press notices called attention to reductions in operating personnel and time, which raises the question as to whether the affected products may not now be priced beyond the reach of a large number of consumers.

Should the threatened fourth round of wage demands be forced through, this condition may be accelerated. Already, export sales have dropped, primarily because of prices, and many expansion programs have been halted. One business executive, as a result of an overseas tour, reports that inquiries showed that European wire mills, formerly our customers for wire machinery, are buying English, German and Italian machines now because they can purchase them at prices up to 40% less than American-made equivalents.

This circumstance is mentioned, not because there is anything wrong with buying to best advantage, which does not affect us at the moment, but because when we need this business, our price differentials will have closed these markets to us. This is something to consider, especially in the light of Marshall Plan expenditures, if it be true, as reported, that European industrial recovery had already achieved greater than pre-war levels prior to the flow of Marshall Plan monies to participating countries. This heavy drain upon our resources tends to maintain our own costs at prohibitive levels.

Hearings on the present pricing system for steel and other materials is piling up evidence that unless the conventional basing point prices are restored, we will be faced shortly with an industrial revolution that will jar our economic system to its roots. No indication is in sight as to what action may be taken by the new Congress, but it is disheartening to note that the Department of Justice and a number of senators still appear to be unconvinced by the logic and unanimity of the testimony.

Steel scrap has been in fairly good supply, except on the West Coast. For the increased production schedules of the coming year, however, greater quantities will be needed and there should be no abatement in the drive to collect and distribute it. Because of Government stockpiling, copper has become short and the demand for copper scrap has accelerated, with a consequent disturbing price increase.

Most large electric wire and cable mills have an ample supply of copper for the present, but several are reported to have had to curtail operations. The demand for heavy cable is strong and its manufacturers are operating at high levels.

Lead has been very tight, due to the longshoremen's and the St. Joseph strikes, although prices have been slightly easier.

Zinc, due to stockpiling, is not only short, but promises to become more so, especially in view of the long continued American Zinc strike.

Steel and aluminum are among the few basic metals that have not kept pace with demand and are expected to be tighter this year than last.

In wire mill circles, while there has been a small recession in the demand for some wire products, the overall pressures of demand runs high. Rods are short, but in better supply than a year ago, with cold heading, fencing, and nail wire reported difficult to obtain. Among the items that have eased are upholstery and poultry netting wire. Cases of substitution of other types of wires for those commonly used are frequently encountered in many fabricating operations.

There are numerous guesses as to which way the new Administration will turn. Our general problems will remain the same, but it would be encouraging to know that our Government has awakened to the awareness of the fact that the policy of spending for the sake of keeping an economy from sagging can never, as a long-range project, accomplish its ends. Business in general is expected to be good and any changes are more than likely to be slow and moderate.

—from the Editor's Desk

UPRIGHT ★ ★ ★

★ ★ ★ CONE

Wire Drawing Machines

FOUNDED WATERBURY FARREL 1851

THESE high speed machines are available in several sizes and can be had with either a coiling block or spooler. The spooler may be an attachment or a separate floor-type device, such as shown. This is the No. 4 machine with belt-type cradle spooler. It is driven by a direct-coupled motor (not shown), has 13 dies and capacity for drawing copper from ¼″ maximum starting size down to a finishing size of from No. 10 to No. 18 B. & S. gage. The dies and the hardened steel drawing rolls are enclosed by a rolling steel curtain to confine the splash of the drawing lubricant.

WATERBURY-FARREL
FOUNDRY & MACHINE COMPANY
Waterbury, Connecticut, U. S. A.
SALES OFFICES: CHICAGO CLEVELAND NEWARK, N. J.

WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 24 JANUARY, 1949 No. 1

Designated as
Official Publication By The Wire Association

Contents

Editorial Page 29

54 Years in the Wire Business
by C. L. McGowan 33

Isothermal Heat Treating—Part I
by Prof. F. R. Morral 39

Wire Association Proceedings,
Technical Meetings, October, 1948 49

The Wire Drawing Die
by Kenneth B. Lewis 67

Labor Relations by John B. Stone 72

Outstanding Personalities of the Wire Industry 77

A Review of Recent Wire Patents 82

Index to Advertisers 107

Where-to-Buy 108-112

WIRE and WIRE PRODUCTS is indexed regularly by Engineering Index, Inc., New York, N. Y.

— ASSOCIATE EDITORS —

Kenneth B. Lewis, Consulting Wire Mill Engineer

Lancaster, Allwine & Rommel, Consultants on Patent Information

Richard E. Brown, General Manager
R. S. Spengel, Business Manager
E. D. Sickels, Advertising Manager

Publication Office: Jersey City, N. J.
Executive Office: Stamford Trust Co. Bldg., 300 Main St., Stamford, Conn.

Annual Subscription, U. S. $5.00, Canada $5.00
50 Cents a Copy in U. S. Issued Monthly Foreign $7.50
October Convention Issue $1.00 a Copy
January Convention Discussions Issue $1.00 a Copy

Copyright 1949, Quinn-Brown Publishing Corp. WIRE AND WIRE PRODUCTS is fully protected by copyright and nothing that appears in it may be reprinted wholly or in part without permission.

NILES

FLANGED STEEL TRAVERSES

...eliminate the labor of handling large numbers of small parts ... make it easy to assemble reels in four simple steps.

And, they make up into strong reels that can be used over and over. Actual experience records show as much as sixteen years' service without refinishing or major maintenance, as well as a 50% to 100% increase in the number of trips before cut downs or scrapping of wooden heads.

Niles Flanged Steel Traverses are manufactured in sizes up to 56" diameter and 48" traverse—in plain, painted or hot dip galvanized finish—as light as 18 gauge steel. Width of flange and number of bolt and drain holes are furnished to your specifications. *Write for prices.*

• • •

Manufactured Under License Arrangements With Western Electric Co., Inc.

REPUBLIC STEEL

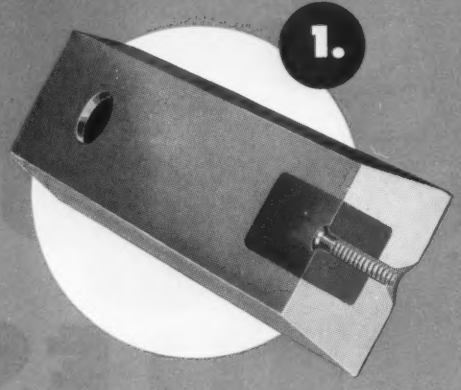
NILES STEEL PRODUCTS DIVISION

REPUBLIC STEEL CORPORATION

NILES • OHIO

HOW *Firthaloy* MAY TURN *loss* INTO *profit* IN YOUR NAIL MILL

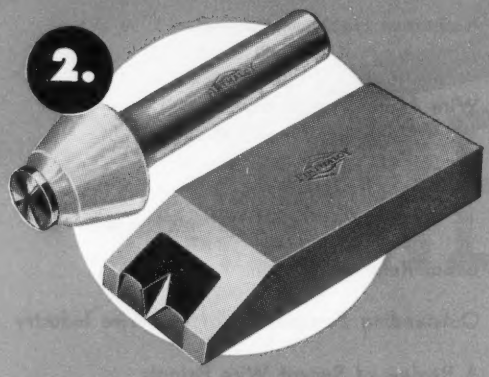
These are the modern mill efficiency aids that Firthaloy offers to nail mills—



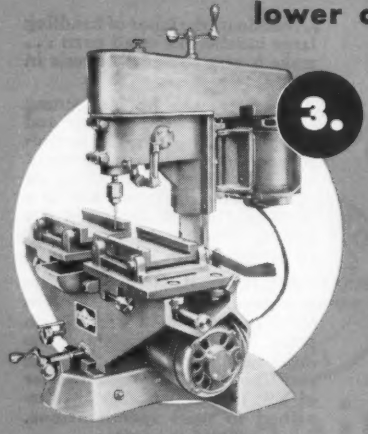
1.

FIRTHALOY NAIL GRIPPER DIES **of new and improved design—produce better quality nails than ever before—and provide long, continuous die life.**

FIRTHALOY KNIVES AND HAMMERS— **excellent applications for assuring uniform high quality results at lower operating costs.**



2.



3.

SPECIAL FINISHING MACHINE **— the exclusive *Firthaloy* Nail Barbing Machine with complete range of barbing needles saves time and money in finishing and in keeping nail dies in top condition in your own shop.**

4.

FIRTHALOY SHOP SERVICE **— is at your call to train your operators quickly and easily to get the most out of your *Firthaloy* equipment.**

FIRTHALOY

"THE STANDARD CARBIDE"

Call Firth Sterling

STEEL & CARBIDE CORPORATION

McKEESPORT, PA. • NEW YORK • HARTFORD • PHILADELPHIA • PITTSBURGH • CLEVELAND
BUFFALO • DAYTON • DETROIT • CHICAGO • LOS ANGELES

WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 24 JANUARY, 1949 No. 1

54 Years In The Wire Business

By C. L. McGowan, Superintendent
Wire Mills
Atlantic Steel Company
Atlanta, Ga.

THE MORDICA MEMORIAL LECTURE, 1948

This lecture is an interesting review of the past 54 years of the Wire Industry. It was presented at the annual Wire Association Convention in Pittsburgh, Pa., October, 1948.

AMONG the old time Irish there was a strong belief that those near and dear to one never actually departed this earth. Get a group of friends together and start remembering some of the gay and happy times enjoyed with the deceased and sure enough, one of the assembled company would feel a light touch on the cheek like a fragile kiss or hear a bit of sweet music. This indicated to one and all that the lost one was close by and glad to know that he or she was remembered by those left behind. Of course, the ideal place to hold such a session was in surroundings familiar to the person who had gone beyond.

★ ★ ★

IF that old superstition had an iota of truth in it, surely one of us assembled here will feel a light touch on the cheek or hear that sweet music for we are gathered in a spot that held many memories for the man in whose honor we go back half a century to reminisce on days gone by in which he played his pioneering role. If the spirit of John Mordica could roam about at will, I am sure that he would be with us today—and perhaps he is!

★ ★ ★

I WAS less than 50 miles from this very spot when I first met Johnny Carter. His folks and mine were neighbors in New Castle, Pennsylvania. John himself was about 16 years old when I first knew him in my pre-school days. There were numerous Carter kids and numerous McGowan kids and we all played together. My brothers and his brothers were good friends and my mother always spoke of Mrs. Carter as a "good neighbor." Mr. Carter, like my father, was in the wire business and in those days it meant moving from place to place, so after a few years my family moved to another town, the Carters moved somewhere else and it wasn't until 1900 that I met Johnny Carter again.

★ ★ ★

ONE day in Ironton, Ohio, when I was working at Belfont a fellow I knew from Kelly's mill asked if I knew a John Mordica who was also from New Castle. Imagine my surprise on meeting Mordica to find out that it was my old friend, Johnny Carter. Now a married man, he was using his own surname. In our boyhood days he had gone by his stepfather's name due to the extreme devotion that existed between the two. All of his life John Mordica was devoted to his stepfather and no natural son and father have ever been closer than these two were.

★ ★ ★

JOHN at this time was working, as I said, at Kelly's mill and I was at Belfont. Contrary to belief we never worked in the same mill.

★ ★ ★

AFTER our days in Ironton I went on to Peoria and John moved to Ashland, Kentucky, then on to Kenova, West Virginia, and finally to Johnstown. During the years we had many a friendly reunion and always managed to keep in close touch with each other from that day on.

★ ★ ★

WHEN John was first beginning his plans for organizing the Wire Association, I happened to run into him one day in this same hotel. He told me his dream and I remember telling him that I didn't think it would work. I was convinced that the men in the wire business could never get together on a common meeting ground. My reason for feeling this way was because of the fact that most of the old timers like John and myself had learned our lessons the hard way. We had no text books from which to get our formulas.

★ ★ ★

IN the early days, you couldn't get a course in two or four years that would teach you the funda-

IN MEMORIAM

JOHN MORDICA
1873-1937

mentals of the wire business. When we were coming up, it was like pulling teeth to get an old timer to tell you anything. Their stock answer was "No one told me." I assured John that he could count on me as a charter member, but I was afraid he would encounter resistance from others in the industry. How wrong I was and how right he was is amply proved by this assembly today. The Wire Association was formally organized here in this hotel within a year, and today is a living memorial to John Mordica.

★ ★ ★

THE best way I know to give you a picture of what went on in the wire business from the time I first met John Carter in New Castle until the formation of the Association is to tell you my own story of 54 years in the wire business, which is pretty much a duplication of the experience John Mordica could relate to you if he were here today. Like him, I started a long, long time ago.

★ ★ ★

I WAS literally born into the wire business. Despite my Southern accent my early boyhood was spent within 50 miles of Pittsburgh. The first mill I can remember was the nail mill of the Hartman Steel Company and the keg shop of Edwin Bell and Son at Beaver Falls, about 30 miles west of here. My uncle, J. C. Maloney, was superintendent of the nail mill there and my father had the cleaning, packing, sorting and shipping departments of the nail mill. Three other uncles were in the nail mill while my grandfather, another uncle and a cousin worked in the wire mill and still another uncle in the rod mill. While I never worked in that mill, I made many a visit to it. In later years I did work at the keg factory for five cents an hour—ten hours a day!

★ ★ ★

ABOUT 1887 a new mill was opened in New Castle and many of the men from Beaver Falls, including some of the members of my family moved there. Among the men who came to New Castle when the mill opened were the Igoes. Peter Senior was day boss of the wire mill. His son, Tom, was night boss and our own Peter Igoe was in the cleaning and packing department. Another old timer, George Paff, was I believe, millwright at New Castle.

★ ★ ★

WHEN Cleveland was serving his second term as President and the panic of 1892 hit, combined with the tragic Homestead Strike, my family moved to New Philadelphia, Ohio, where another new wire and nail mill had been put in operation. I was still too young to work in the mill, but made almost daily trips there to take my Dad his lunch. I can recall that the superintendent of the wire mill was having a lot of trouble with production due to the fact that the wire drawers wouldn't work steady. They'd report for work in the morning, but about ten o'clock they'd knock off and walk a mile to town to the nearest saloon for a glass of beer. It was an established fact at that time that wire drawers had to have beer on account of the lime dust. Finally, in desperation the superintendent promised to have beer delivered to the mill each morning and give the boys a drink on the house for each hour they worked. Believe it or not—it worked! That was my first experience with the incentive system.

★ ★ ★

AFTER a few years in New Philadelphia the seasonal slump which plagued the early industry and accounted for much of the roving of the old timers, hit again and with times still hard, the McGowans moved to Braddock, which is about 10 miles from Pittsburgh. With every nickel counting I had to leave school and take my first job at the Pittsburgh Wire Company which was later sold to Consolidated, then to American Steel and Wire and which plant has since been dismantled. When I went there it was a new mill and I worked for my Dad on the packing floor. When I was promoted to weigher at seven and a half cents an hour, I was a happy kid. Later I was able to get a job as nail machine helper at ten cents an hour. Here I learned my trade and became a full fledged nail machine operator, proud of the fact that I was the youngest operator in that mill. My job adjoined the wire mill on one side and the annealing pots on the other side, so in my spare time I learned a bit about wire drawing and annealing.

★ ★ ★

AT that time the Braddock mill was considered a very modern operation. It produced 500 tons of wire and specialized in wire for nails and barb wire. The baker was coal fired from underneath and required a fireman on each turn who in addition to firing had to wheel his coal and ashes. There were two cleaning circles and a smaller one for copper coat and soft wire. There were several annealing outfits and these were loaded while cold, the pot sealed with fire clay and a fire built under them. Timing and temperature were guess work. When the fire was allowed to die out slowly, the wire remained in the pot until the pot cooled. This required a couple of days. The battery of pots was handled by a steam driven crane that travelled on a track parallel with the pots.

★ ★ ★

ALL of the wire drawing machinery was old style single draw benches driven by steam engines. A drawer who drew four to five tons in ten hours was considered a good tonnage man. In those days a wire drawer had to have considerable more experience than a like man today. All first class wire drawers were also what was known as plate setters. Wire was drawn through a set of plates each with 12 to 18 tapered holes in it. These plates had to be battered hot which was usually done by the drawer and his apprentice at the end of their turn. They came in early next morning and set the plates before going to work. There was no question of time and a half in those days as it was all tonnage. A young fellow started by helping an older wire drawer and his first job was redrawing on what was known as the fine bench. As he grew more experienced he was promoted to the rod bench and he was then on his own.

★ ★ ★

AMONG the men who will be familiar to you who were at Braddock in those days was a young chap named Frank Nullmeyer who was in the engineering department. James Farrell was in the sales department and later was works manager before going on to make history in the steel industry. His brother, Bill, was superintendent of the wire mill.

★ ★ ★

IN 1899 I moved on to a little mill down the Ohio River called the Ohio River Nail Company at a place called Anderson Roads about five miles from Aliquippa. This was quite a small mill after Braddock and poorly equipped. They purchased rods outside and had one old time single draw bench with the pull-in operated from eccentric cam under the blocks. They had three wire drawers who did all the cleaning of the rods and set their own plates. The cleaning house was very crude and had no steam crane. There was only one boiler. A hand wound winch was used to raise the yoke of rods from the cleaning tub. There was no lime tub and the yoke was put over a sump and lime thrown over the rods with a bucket. The rods were next put on a two wheel truck, similar to those used around a railroad station to haul baggage. The baker was just a closed room where the rods were put and a coal fire built at floor level was used to heat it. Often the bricks would fall in and the rods would come out black with soot instead of white.

★ ★ ★

THERE were only 15 nail machines, all antiques. The feeders on these machines consisted of two pieces of leather. The wire went between the two pieces of leather and a spring gave the tension to force the wire into the machine. The nail operator had to make his own dies, cutters, headers, do his own tempering, his own repair work and upkeep on the machines as they had only one machinist for the entire mill. In addition to the other duties, the nail operator also assisted in keeping a pump running on the banks of the Ohio River—and believe it or not, gentlemen, we turned out pretty good wire and pretty good nails.

AFTER one year at this plant I moved to Ironton, Ohio, where the Belfont Iron Works, an old time company that had made iron cut nails, had decided to go into the wire nail business. They added a wire, nail, galvanizer and barb wire mill. Machinery was installed by Turner-Vaughn-Taylor Company and the Vaughn in the firm was the father of Lee Vaughn of the present Vaughn Machinery Company.

★ ★ ★

THE wire mill had the first bench I had seen with continuous pull-in chain, the wire drawers had their plates set for them, a good cleaning house and a gas fired baker so the wire drawers had nothing to do but draw wire.

★ ★ ★

THE nail mill had a tool maker and a knife grinder and a good mechanical department so the operator had only his eight machines to look after. Of course, we had only tool steel and many days were kept busy changing tools on account of breaking dies by being too hard or too soft. In those days, the eye was still being used to gauge the temperature of hot steel. It was while working here that I saw the new mushet self-hardening steel and it wasn't long until all the nail headers had a mushet insert. This was quite an improvement on header grinding for instead of daily grinding it was stretched to weekly grinding.

★ ★ ★

EARLIER I mentioned seasonal shut-downs in the early industry. This was widespread and in the days before unemployment insurance resulted in a lot of hardship for workers and took many capable men out of the industry. Management, too, had problems on this score as a mill would go down with a full crew and when it reopened a few months later all of the trained wire drawers, nail operators and other skilled workers had moved on to other mills or to jobs in other fields. During a shut-down, you earned a living any way you could. I know that I have put in many hard licks in off-season months working in a hotel, in a summer amusement park, with a construction gang and other odd jobs that came my way. I recall that once when the mill was down in Ashland, I believe it was, John Mordica made a living as a photographer. So, you see, the early wire mill man had to have other talents than skill at his chosen trade.

★ ★ ★

DURING one of the shut-downs at Belfont I went to Kokomo, Indiana, to work for the Kokomo Nail and Brad Company, a small concern who purchased their wire and made small brads, cigar box nails, brass nails and other specials. After five months here I went back to Ironton and when the next shut-down came I moved to Peoria where the Keystone Fence Company had just put in a new wire mill, wire galvanizer and eight new nail machines and one staple machine. I signed up as foreman of the nail mill, combined with the duties of time keeper, packing boss, tool maker, knife grinder and staple maker. I supervised the installation of the nail machines and shortly after we got the mill in operation, the nail operator—who was supposed to do everything I didn't do—went on a protracted drunk and I ended up by being the whole nail department.

★ ★ ★

THE equipment in the Peoria mill was modern and up to date at that time. The wire galvanizer was oil fired which gave them more uniform heat than could be achieved with coal or coke. When a wire drawers' strike shut down the Peoria mill, I once again headed back to Ironton. For your information, Mrs. McGowan was at that time Miss McFadden of Ironton, Ohio.

★ ★ ★

THE mill at Ironton was also closed but while I was there I was told that there was a labor agent in town seeking skilled nail makers to go to Ensley, Alabama. In those days it was standard practice for mills to employ labor agents who toured the country rounding up workers. I mention this incident to give you an idea of the poorer type of employee relations that existed in the early days.

These labor agents painted glowing pictures, drawing on their imaginations for most of the details. They concentrated in areas where mills were down. They promised such things as rail fare, high wages, etc. In my case, I was offered transportation to Alabama, 30 cents an hour—which was high then—and work in a brand new mill.

★ ★ ★

WHEN I arrived at Ensley — what a different story! First of all, the rail fare came out of the first month's check. We were paid only once a month but the company generously offered advances to any who needed them and it wasn't until later that you learned that the advances bore interest at ten per cent.

★ ★ ★

THEY had had a fire in the mill and the roof had collapsed damaging all of the machinery which was already old broken down equipment. The company had built a new building and the operators were expected to salvage all the old machines and get them in operation in the new building. —This was the brand new mill of which we had been told!

★ ★ ★

REALIZING that it would be impossible to learn anything in this set-up, I quit after three months and went to Atlanta where the mill had been in operation for just three months. This was a brand new mill with all new equipment. I signed up as die maker and knife grinder for by this time it was standard practice not to require nail operators to make their own dies. The Atlanta plant hired me with the understanding that I would stay until spring. That was in the summer of 1906.

★ ★ ★

IN 1908, Tom Girdler, who was general superintendent at Atlanta, promoted me to superintendent of the wire mills. In 1909 I took over the spike mill and from 1921 to 1934 I was also superintendent of the rod mill. When I went to Atlanta it was a 60 ton mill. Originally we had 18 wire blocks and 32 nail machines, a 12 block galvanizing outfit, coke fired.

TODAY the Atlantic Steel Company is a 300 ton mill with 28 continuous machines, 110 nail machines, 12 rivet machines, 3 staple machines and a modern 36 block take-up galvanizer. Not only in the number of pieces of equipment but in the methods of operation many changes have been made since 1908.

★ ★ ★

FIRST of all, steel itself has greatly improved. It was common talk in the old days that anything was good enough for the wire mill. Many off heats found their way into the wire mill causing run outs and cut out plates. There was no attention paid to the different grades required for nails, barb wire, finishes, etc. There was one stack of rods in the yard and you made all your wire from that. To acquire the degrees of stiffness required, it was necessary to obtain this by the different amounts of drafting. In days gone by there were only three grades of steel—soft, structural and intermediate. Soft and structural were used for wire and no attention was paid to the chemical analysis after the steel left the open hearth.

★ ★ ★

TODAY you have different grades for different requirements and every heat of steel is followed through all departments. Every truck of rods bears a tag showing heat numbers and the chemical analysis. This makes the job a little easier and if the old timers in the wire industry did nothing else—we did convince the boys in the front office that you could make better wire only with better steel.

★ ★ ★

A MODERN cleaning house of today is a far different place than was its prototype of years ago. At that time pickling was done in wooden tubs, set in a semicircle. Tubs were constantly leaking and so much steam arose, especially in cold weather, that it was impossible to see across the room. Workmen wore rubber boots and aprons to protect their bodies from splash and slop on the floor. You may wonder how it was possible to tell whether the stock was clean under those conditions? As a matter of fact, it wasn't — and considerable stock ready for drawing was often sent back to be recleaned.

★ ★ ★

IN our mill today we have an up-to-date cleaning house with a two line installation which makes it possible for the crane to complete its circuit without returning empty. The steel tanks, rubber lined with acid proof brick laid with basolit, are a big improvement on the old wooden tubs. Instead of leaking, they build up the liquid volume from constant condensation of steam.

★ ★ ★

AS far as bakers are concerned, the old hit or miss method where temperature ranged from 100 to 250 degrees is now all old stuff. Now you have air recirculating gas controlled bakers with automatic constant temperature of 350 degrees. The new flash baker is still another improvement in this field.

★ ★ ★

WIRE drawing methods and equipment have shown considerable improvement. When I went to Atlantic Steel Company the one 18 block wire drawing bench was driven by a shaft running full length of the bench below the floor line. There was no way to change the speed of any of the blocks without changing them all. A mill thus geared to a single shaft was extremely inelastic since the equipment could not be regulated to meet demands. The result was that most of the time a few blocks were standing idle, bringing in no return on investment yet consuming power, requiring lubricants and necessitating repair expense. The first block was used for coarse wire, seven jobs of two blocks each were used for drawing two and three hole wire and of these the first block was used for the first and second draft and the second block was used for finishing. Five to six thousand pounds was average for ten hour production.

★ ★ ★

IT was in the drawing of larger sizes of wire that the old time husky wire drawers were needed for after drawing, the block

had to be stripped — that is, the wire had to be removed from the block. To do this, the wire drawer lifted the wire from the block and carried it to a truck or reel, the bundles often weighing 220 pounds. In the summer, efficiency was much reduced because of the heat. Today with improved processes, bundles have increased in weight until in one plant at the present time they weigh as high as 900 pounds. Of course, under these circumstances it is out of the question for men to strip blocks without mechanical assistance. In the old time wire mill steel plates were used and later chilled cast iron dies were put in operation. Lubricants consisted of wire drawing grease and lime. The same mixture was administered for all grades of wire. The speed was about 400 feet per minute as compared to 1200 to 1800 today.

★ ★ ★

IN my opinion the biggest improvement in methods of operation in the wire mill is, of course, the carbide dies which made possible high speed continuous machines. To appreciate the worth of these machines you have only to look back to what we had in the past.

★ ★ ★

TWENTY-FIVE years ago a wire drawer was considered an expert if he could pull one ton of rods, a normal draft, through a single hole without resetting and re-sizing the die. Today it is common practice to draw as much as 200 tons of wire through the same die. The tungsten carbide die has thus taken away a large part of the art, or glamour or romance of drawing wire from the wire drawer himself and made the operation of drawing wire more or less a routine task.

★ ★ ★

THE nail mill hasn't changed a great deal with the exception of the use of carbide dies and cutters and the new higher speed machines.

★ ★ ★

SEEKING to lower costs we began using carbide dies about 1937 and were among the first, so I am told, to experiment with them. We now use them exclusively in our nail mill. They are successful and today an operator runs 16 to 18 machines as compared to 8 to 12 with tool steel dies. They tell me that they don't work as hard now as they did with fewer machines.

★ ★ ★

WORKING with tool steel dies a machine used one to six pairs a week according to the hardness. With carbide dies we have many pairs that have been in operation over six months.

★ ★ ★

IN the beginning there was trouble in getting the operators to learn to use carbide dies. One of the difficulties was that they were used to steel dies and in the habit of pinching them. Of course, carbide dies being brittle wouldn't stand the shock and it was a tough educational campaign to win the men over.

★ ★ ★

FOR the benefit of any who may be contemplating the use of carbide dies in the nail mill, I can pass on a few bits of advice learned from our experience. First, your machines must be kept in first class condition, especially the cross head. You will not have success with carbide dies if there is any lost motion in your machines. Machines must be stopped immediately as the wire runs out. If not, you will break the dies. Your die block should have a hardened steel plate on the bottom so that there will not be any rocking of the die.

★ ★ ★

DIES should be taken out occasionally and cleaned. Otherwise, grease and coating off the wire will get between the dies causing your machine to run hot. A good operator will soon learn to judge the cleaning time. Again, be sure your operators don't pinch. Time spent in teaching the operator on this point will be well worth the money and save many broken dies.

★ ★ ★

WHILE we have been successful with carbide dies, we have not been successful with carbide cutters. However, I blame this on the old style machines as we have found that on the few modern machines we have that the carbide cutters work well.

★ ★ ★

IT is my guess that sometime in the future all nail mills will use carbide dies and cutters, cutting down enormously on the cost of operation. The day isn't far distant when an operator will run 25 to 30 machines. From this you can see that we have encouraging prospects of making cheaper nails — the next thing to look for is a cheaper container.

★ ★ ★

IN the rivet department today you use a special grade of steel known as rimmed steel which eliminates cracked heads. We also use carbide dies on our rivet machines and have noted improvements in costs. In the old days, the grade of steel which was just soft steel produced plenty of defects. Many of the special heads made today were an impossibility 20 years ago.

★ ★ ★

IMPROVEMENTS in the galvanizing of wire have been numerous. It used to be that you could run only one grade of wire at a time. Today with improved equipment it is possible to run coat hanger wire, barb wire, fence and market wire at the same time. Instead of the one old time unit you now have variable speed take up units which allow you to get the desired tensile. The galvanizing kettle instead of being shallow bottom fired is now a deep side fired kettle. Practically everything has changed except the galvanizing formula which still calls for spelter.

★ ★ ★

THE primitive annealing pot which I described at the Braddock mill is a far cry from today's annealing furnace which has a capacity of one ton per hour. In between were furnaces of the 1910 vintage which were coal fired with a capacity of 6 tons in 24 hours. Later there was the gas fired furnace with three units that turned out 7 tons in 24 hours.

★ ★ ★

IN 1911 when we put in our first field fence machines, old style staple lock fence was then in demand. Today the modern hinged

(Please turn to page 104)

ISOTHERMAL HEAT TREATING

A Compilation
by Prof. F. R. Morral, Ph.D*
Dept. of Materials Engineering
Syracuse University
Syracuse, N. Y.

Part I.

T-T-T diagrams may be drawn for many of the nearly 500 analyses assembled in this article, which will be published in two parts. Omissions and errors brought to the attention of the author will be appreciated.

THE metallurgist and the heat treater are aware that many advances have been made in the last twenty years in the art and science of heat treating. This paper includes a summary of some of those advances and presents data of practical value to anyone engaged in heat treating.

* * *

AT one time the skilled blacksmith was able to heat treat by the process now called "interrupted quenching." Today, such individual skill and experience have been largely replaced by controlled timing, often by mechanized equipment.

* * *

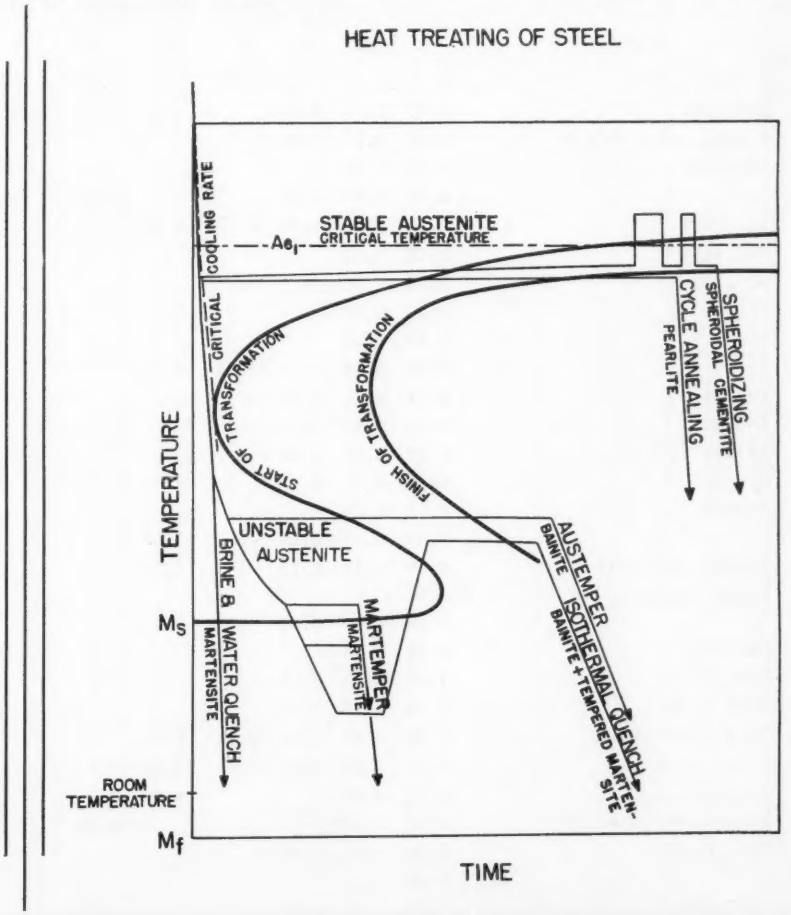
BREARLY (60) possibly was the first to suggest that a process similar to that used in patenting of wire could be given wider application. Since then **Chevenard, Portevin, Lewis, Wever, Davenport, Bain, Payson, Greninger, Cohen, Shepard** and many others have contributed to change the art of heat treating into the science of modern, controlled, practical heat treating.

* * *

HEAT treating makes possible the improvement of the properties of steels. To heat treat the steel it must be brought to and held at the hardening temperature, now usually called the austenitizing temperature because above the critical temperature steel changes into stable austenite. The stable austenite on cooling below the critical temperature becomes unstable and decomposes. The decomposition product depends on how fast the steel is cooled, the temperature to which it is lowered and the length of time held there. The time for the start and for the end of the transformation of austenite at a given temperature can be plotted. The lines drawn through these points are "S" curves so-called because of their shape, but more appropriately named T-T-T (Time-Temperature-Transformation) or I-T (Isothermal Transformation) diagrams.

* * *

THE properties of a steel (strength, hardness, machinability, fatigue, etc.) depend on the decomposition products of the austenite. If the austenite is cooled faster than the critical cooling rate (Fig. 5) to the Ms temperature or below, **martensite,** the hardest decomposition product of austenite, forms. Ms is the high-

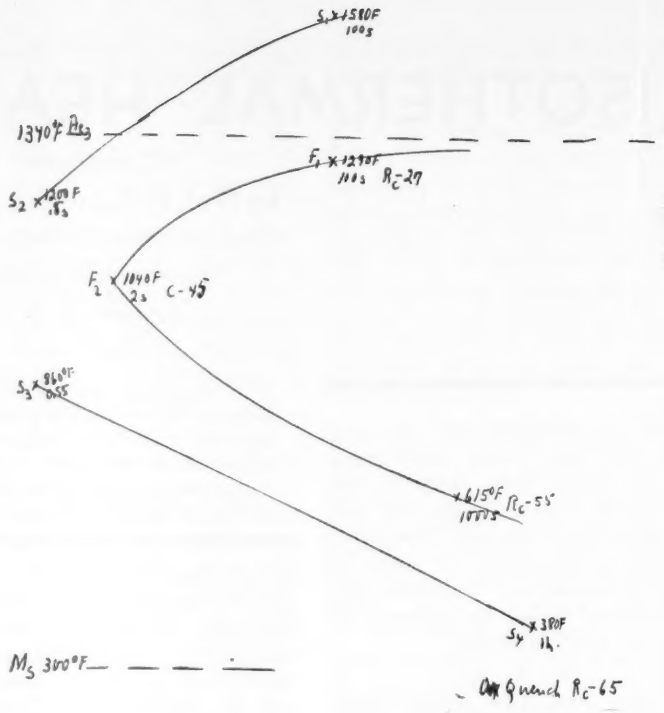


*Formerly at American Cyanamid Research Lab., Stamford, Conn.

est temperature at which martensite first forms. The temperature at which the austenite has completely transformed to martensite is known as "Mf" of "finish" of the austenite-martensite transformation. The amount of austenite transformed to martensite within the above range depends on the temperature. The austenite-martensite transformation is so fast as to be virtually independent of time.

* * *

AUSTENITE transforms to different products between the Ae and the Ms temperatures, depending upon whether the steel is cooled slowly or held at some definite temperature in the above range. The latter type of treatment is known as an isothermal treatment. The time it takes at a



INDEX TABLE-CHEMICAL ANALYSIS

CHEMICAL COMPOSITION IN PERCENT

	STEEL	C	Mn	Si	N	Cr	Mo	W	OTHERS	REFERENCE	TYPE	NO.
1	C 1012	0.12	0.65	0.26	0.06		0.008			1	I	1
2	SAE 1025	0.25	0.54	0.14						2	I	2
3	C 1030, cast rolled	0.30	0.75	0.46						3	I	3+4
4	SAE 1035	0.35	0.37							4	I	5
5		0.45	0.67	0.26			0.009			1	I	6
6	SAE 1050	0.46	0.80	0.19	0.17	0 13				5. 6	I	7+8
7	SAE 1050	0.50	0.91							4	I	9
8	WD 1055	0.54	0.46	0.20						4	I	10
9		0.55	0.50							7	I	11
10		0.59	0.30							8	I	12
11		0.65	0.39	0.19	0.16	0.03				9	I	13
12	C-1064	0.64	0.68	0.22						4	I	14
13	C-1066	0.63	0.87	0.15						4	I	15
14	X-1065	0.63	0.87	0.15					B-.0025	4	I	16
15		0.78	0.36	0.16						10	I	17
16	C-1080	0.79	0.76							4	I	18
17		0.85	0.23	0.18	0.05	0.07				6	I	19
18	C-1086, SAE 1095	0.89	0.29	0.15		0.11				10. 4	I	20
19	Powder alloy	0.88								11	I	21
20		0.88	0.41	0.41						12	I	22
21	SAE 1095	0.95	0.45							8	I	23
22	Tool steel	1.13	0.30	0.17						4	I	24
23	Tool steel	1.14	0.22	0.16						13	I	25
24	Tool steel (Navy)	1.16	0.27	0.21	0.08	0.11				6	I	26
25		1.17	0.03	0.18		0.26				14	I	27
26	See 124	1.17	0.30			0.26				8	I	28
27	Rolled and carburized	0.20	1.00				0.10			26	II	1+2
28	QQ - W 474	0.64	1.13	0.09						4	I	29
29		0.65	1.1							7	I	30
30	Al-0.010	0.17	1.21	0.27	0.13		.04		V-.008,Cu-0.25	2	I	31

INDEX
TABLE-Continued

	STEEL	CHEMICAL COMPOSITION IN PERCENT C	Mn	Si	Ni	Cr	Mo	W	OTHERS	REFERENCE	TYPE	NO.
31	Al-.020	0.17	1.19	0.24	0.10		0.3		Ti:.007 Cu-0.20	2	I	32
32		0.18	1.21	.35						15	II	3
33		0.65	1.32							8	I	33
34		0.39	1.67		<.10					16	I	34
35	T-1335	0.35	1.85	0.19						8	I	35
	Not homogenized									4	II	4
36	SAE 1340 (forged)	0.43	1.57	0.23	0.20	0.12	0.07			17	II	5
37		0.51	1.56	0.04	0.04	0.03				18	I	36
38	A 1350	0.55	1.89							15	I/II	37+6
39		0.87	1.78	0.29	0.15	0.20	0.03			19	II	7
40		0.47	2.10	0.01	0.04	0.06				18	I	38
41		1.02	2.41							15	III	1+2
42		0.77	2.90							15	III	3
43		0.52	3.23							15	II	8+9
44		0.55	3.9							7	I	39
45		0.53	4.05	0.01	0.04	0.04				18	III	4
46		0.51	4.12	0.03						15	III	5+6
47		0.63	5.05							15	III	7
48		0.99	5.20							15	II	10+11
49	Silicon Steel	0.50	0.23	0.53		0.05				4	I	40
50		0.54	0.23	1.27		0.05				4	I	41
51	Silicon Steel	0.53	0.23	2.32		0.32				4	II	12
52	Pearlitic Malleable	2.60	0.45	1.40						20	I	42
53	Cast Iron	2.9		2.1						21	I	43
54	Cast Iron	2.9		2.1			0.50			21	I	44
55	Cast Iron	2.97	0.82	2.02						22	I	45
56		0.60			0.50					7	I	46
57		0.61	0.26		0.94					4	I	47
58		0.57	0.24		1.94					4	I	48
59	2¾ Niforging steel	0.29	0.77	0.23	2.72	0.04	0.05			23	II	13
60	A 2330, cast steel & rolled	0.28	0.69	0.41	3.30	0.12	0.03			3	III	8+9
61	W D 2340,A See addenda	0.30	0.58	0.29	3.11	0.20				6	III	10
62		0.36	0.56	0.31	3.26	0.16				24	II	14
63		0.33	0.23	0.06	3.78					25	IV	1
64	2340	0.37	0.68	0.21	3.41					4	I	49
65		0.50	0.73		3.92	0.04				16	II	15
66		0.58	0.33		3.88					4	I	50
67	2515	0.14	0.51	0.22	5.29					6	I	51
68		0.38	1.51	0.26	0.40	0.99				59	III	11
69	G.M.C. X-3045.A.	0.44	0.97	0.31	0.72	0.86	0.01			23	II	16
70	3120	0.20	0.70	0.27	1.25	0.65				26	II	17
71	3120	0.21	0.61	0.24	1.35	0.64	0.02		Cu-0.04	23	II	18
72	3140	0.38	0.72	0.21	1.32	0.49				4	II	19
73		0.39	0.71		1.15	0.75				27	II	20-23
74	3140	0.40	0.80	0.27	1.25	0.65				26	II	24
75	3190 (see 71) .-carburized	0.91	0.65	0.23	1.35	0.60			Cu-0.03	23	III	12
76	3240 (see Addenda)	0.41	0.48	0.27	1.68	1.05				6	II	25
77	3312	0.10	0.34	0.20	3.51	1.66	0.06			6	III	13
78	3330	0.29	0.21	0.06	3.25	1.45				28	II	26
79		0.34	0.22		3.89	1.87				29	IV	2
80	Modified 3360	0.59	0.34	0.26	3.20	2.26				6	IV	3
81		0.60	0.39	0.26	3.29	2.22				59	IV	4
82	Krupp Type	0.15	0.45	0.20	4.03	1.54	0.03			30	IV	5
83	" " Carbonized	0.89	0.39	0.19	4.00	1.58				30	IV	6
	1475°F + 1850°F									30	IV	7
84		0.54	0.66						U-0.2	16	II	27
85		0.12	0.61	0.27			0.13			1	I	52
86		0.12	0.63	0.25			0.31			1	I	53
87		0.12	0.60	0.22			0.49			1	II	28
88		0.11	0.59	0.25			0.74			1	II	29
89	Austenitized @ 1650°F & 2500	0.22	0.79				0.50			4	II	30+31
90		0.29	1.64	0.24	0.02	0.05	0.45			31	II	32
91		0.27	0.86	0.25	0.05	0.03	0.71			31	II	33
92		0.33	0.41				1.96			8	IV	8
93		0.39	1.10	0.71			0.46			31	II	34
94		0.40	1.00				0.10			26	II	35
95		0.40	0.42				0.52			4	II	36

INDEX
TABLE-Continued

	STEEL	CHEMICAL COMPOSITION IN PERCENT C	Mn	Si	Ni	Cr	Mo	W	OTHERS	REFERENCE	TYPE	NO.
96		0.38	0.17				0.82			4	II	37
97		0.42	0.20				0.21			4	II	38
98		0.43	1.70	0.28			0.17			32	II	39
99		0.43	0.76	0.27			0.67			31	II	40
100		0.43	1.65	0.29			0.36			32	III	14
101		0.45	0.70				1.00		v-0.20	26	III	15
102		0.44	0.65	0.28			0.15			1	I	54
103		0.41	0.69	0.23			0.29			1	II	41
104		0.39	1.58	0.27	0.05	0.16	0.44			31	IV	9
105		0.39	0.67	0.26			0.49			1	III	16
106		0.42	0.55	0.25			0.71			1	III	17
107	SAE 4042	0.43	0.90	0.23	0.23	0.27	0.26			6	II	42
108	AISI 4047	0.48	0.94				0.25			4	II	43
109		0.52	1.18	0.30	0.16	0.13	0.30			31	II	44
110		0.50	1.50	0.17	0.10	0.20	0.45			31	II	45
111		0.65	0.68				0.10			4	I	55
112	AISI 4068	0.68	0.87				0.24			4	II	45
113		0.72	0.32	0.19	0.09	0.09	0.45			31	II	47
114		0.77	0.71	0.29			0.02			33	I	56
115		0.77	0.70	0.29			0.15			33	I	57
116		0.78	0.73	0.28			0.32			33	III	18
117		0.80	0.90	0.30	0.16	0.09	0.44			31	II	48
118		0.77	0.72	0.28			0.52			33	III	19
119		0.79	0.76	0.27			0.77			33	III	20
120		0.71	0.89	0.29	0.25	0.28	0.94			6	III	21
121		0.26	1.51	0.42		0.45	0.30			34	III	22
122		0.30	1.63	0.49		0.44	0.33			35	III	23
123	Austenitized @ 1500 + 1750°F	0.97	1.04				0.32			4	II	49+50
124		1.18	0.76	0.29			0.01			33	I	58
125		1.16	0.75	0.29			0.15			33	I	59
126		1.19	0.77	0.28			0.33			33	II	51
127		1.15	0.76	0.28			0.53			33	III	24
128		1.18	0.75	0.28			0.78			33	III	25
129	Cast Irons	3.14	0.81	2.15			0.0		Combined C 0.65	36	IV	10
130		3.12	0.76	1.91			0.09		0.75	36	IV	11
131		3.04	0.72	1.83			0.15		0.71	36	IV	12
132		3.00	0.73	1.85			0.25		0.82	36	IV	13
133		2.93	0.74	1.89			0.51		0.81	36	IV	14
134	4130 Continuous cooling	0.31	0.47	0.34	0.26	0.92	0.16			37	-	-
135	SAE 4130 see Addenda	0.28	0.65	0.19	0.16	0.66	0.22			9	II	52
136	SAEX 4130, AISI A4130	0.33	0.53			0.90	0.18			4	II	53
137	SAE 4130 Cast steel + rolled	0.32	0.54	0.36	0.07	0.75	0.27			3	II	54+55
138	SAE 4130	0.30	0.74	0.50		0.80	0.25			26	III	26
139	SAE X 4130 Modified	0.29	0.77	0.30		0.68	0.20		Al-0.02	2	I	60
140	SAE 4140 Austenitized at 1500 & 2000°F	0.37	0.77	0.15	0.04	0.98	0.21			4	II	56+57
	SAE 4140 Homogenized									8	II	58
141	SAE 4140	0.38	0.67	0.27	0.08	1.01	0.18			9	III	27
142	SAE 4140	0.38	0.82	0.23	0.29	1.02	0.28			9	III	28
143	SAE 4140	0.40	0.68	0.20	0.21	1.00	0.22			9	III	29
144	AISI 4142	0.41	0.86	0.30		1.06	0.23			6	III	30
145		0.38	0.25	0.31	0.31	0.92	0.24			38	I	61
146	SAE 4140	0.40	0.80	0.27	1.25	0.65				26	II	59
147	SAE 4150	0.55	0.60		0.36	1.03	0.19			4	III	31
148	SAE 4150	0.46	0.77	0.28	0.15	1.06	0.22			9	III	32
149	SAE 4315 Continuous cooling	0.16	0.70	0.42	1.84	0.78	0.35			39	-	-
150	SAE 4330 Cast steel & rolled	0.33	0.69	0.41	1.41	0.72	0.28			3	III	33+34
151	SAE 4330 (see Addenda)	0.31	0.66	0.28	1.67	0.72	0.34			9	III	35
152	SAE 4330 Transformation on	0.26	0.60	0.39	1.77	0.70	0.32			32	-	-
153	SAE 4330 Continuous cooling	0.27	0.73	0.31	1.84	0.72	0.31			40	-	-
154	SAE 4340	0.42	0.78	0.24	1.79	0.80	0.33			4	III	36
155	SAE 4340	0.41	0.73	0.30	1.79	0.82	0.25			2	III	37
	SAE 4342									59	III	38
156	SAE "4360"	0.62	0.64	0.67	1.79	0.60	0.32			4	III	39
		0.75	0.70		1.50	0.75	0.30			26	III	40
157	SAE 4615	0.17	0.57	0.26	1.73	0.13	0.26			9	II	60
158	SAE 4620	0.20	0.55	0.25	1.80		0.25			26	II	61
159		0.33	0.66	0.28	2.13	0.20	0.15		V-0.06	38	I	62
160	SAE 4635	0.32	0.74	0.31	1.70	0.12	0.23			9	II	62

INDEX
TABLE-Continued

NO.	STEEL	CHEMICAL COMPOSITION IN PERCENT C	Mn	Si	Ni	Cr	Mo	V	OTHERS	REFERENCE	TYPE	NO.
161	SAE 4640	0.36	0.63	0.19	1.84	0.06	0.23			4	II	63
162	SAE 4640 Homogenized	0.34			1.87		0.23			8	II	64
163	SAE 4640	0.41	0.76	0.11	1.85		0.25			6	II	65
164	SAE 4815	0.16	0.52		3.36		0.19			4	II	66
165	SAE 48100-Carbonized	0.97	0.52		3.36		0.20			4	III	41
166		0.32	0.57	0.22	3.38	0.65	0.26			41	II	67
167		0.27	0.53	0.26	3.38	0.71	0.18			15	III	42
168	Before and after overheating at 2200°F	0.31	0.44	0.20	3.40	1.26	0.47			42	IV	15+16
169		0.38	0.37			0.57				4	II	68
170		0.33	0.45			1.97				4	II	69
171	SAE 5140	0.42	0.68	0.16	0.07	0.93				4	II	70
172	SAE 52100	1.04	0.35	0.33	0.10	1.35				6	II	71
173	SAE 52100 Austenitized @ 1500 & 1950	1.02	0.36	0.33		1.41				4	II/III	72/43
174	SAE 52100, " at 1500 & 1800	1.06	0.38	0.35		1.35				23,27	I/III	63/44
175	SAE 52107	1.01	0.50	0.30		1.21				13	I	64
176		0.38	0.20	0.18		2.98				16	I	65
177		0.75	0.85			0.50				26	I	66
178		0.50	1.15			0.50	0.15			26	II	73
179		0.44	0.77	0.28	0.18	0.98				16	II	74
180		0.20	0.25	0.17	0.06	3.02				43	II	75
181		0.43	0.91	0.30		1.01				15	III	45
182	Modified Nitralloy G	0.40	0.64	0.20	0.23	1.81	0.39		Al-	6	IV	17
183	Nitralloy 135, modified	0.47	0.57			1.57	0.36		Al-1.26	44	III	46
184		0.30	0.49	0.41	0.04	0.51	0.41			45	III	47
185		0.28	0.49	0.41	0.04	1.00	0.41			45	III	48
186		0.29	0.60	0.40	0.04	1.49	0.41			45	III	49
187		0.30	0.50	0.36	0.03	2.04	0.33			45	IV	18
188		0.30	1.54		0.97	2.05	0.43			46	IV	19
189		0.30	2.50		0.97	2.05	0.43			46	IV	20
190		0.29	0.50	0.34	0.03	2.40	0.34		Cu.0.05	45	IV	21
191		0.33	0.51		0.62	2.32	0.36			47	IV	22
192		0.76	0.27			2.06	0.25			47	IV	23
193		0.08	0.26	0.13		2.93				48	II	76
194		0.15	0.24	0.12		2.91				48	III	50
195		0.26	0.31	0.23		3.11				48	III	51
196		0.38	0.20	0.18		2.98				48	IV	24
197		0.69	0.22	0.12		3.00				48	IV	25
198		1.02	0.33	0.35		2.90				49	IV	26+27
199		1.28	0.29	0.37		2.90				48	IV	28
200		1.04	0.18	0.35		4.00				49	IV	29
201		1.05	0.31	0.35		5.70				49	IV	30
202		1.02	0.33	0.35		8.8				49	IV	31
203	Stainless Type 410	0.09	0.44	0.27		12.60				6,26	IV	32
204		.08	0.47	0.16		12.86	0.32			59	IV	33
205	420	0.40				13.0				14	IV	34
206	420	0.36	0.43	0.49	0.24	13.50				6,26	IV	35
207	AISI 51335	0.35				14.00				27	IV	36
208	Stainless 440A	0.62	0.30	0.17		16.59				6,26	IV	37
209	V.C.M. Nitriding Steel	0.32	0.76		0.70	1.06	1.01			23	IV	38
210		0.14	0.41	0.21	0.19	5.12	0.51			50	IV	39
211	Cro-Mo-die steel See 338	0.28	0.70	0.47		5.25	0.62		Al-0.05	51	IV	40
212	Stainless Type 502	0.06	0.33	0.20		5.04	0.55			6,26	IV	41
213	Stainless Type 502	0.11	0.38	0.44	0.15	5.46	0.42			4	IV	42
214		0.38	0.53	1.08	0.30	5.00	1.15	0.08		59	IV	43
215		0.97	0.48	0.40		4.58	1.04	0.25		13	IV	44
216		1.50	0.30	0.36		11.00	0.74	0.23		6,26	IV	45+46
217		1.55	0.27	0.45		11.34	0.53	0.24		13	IV	47
218	Stainless Type 440B	0.93	0.49	0.43		18.40	0.55			26.6	IV	48
219		0.69	2.09	0.35	0.15	1.08	1.57			59	IV	49
220	SAE 6135 Continuous cooling	0.35	0.67	0.45		0.98	0.23			52	-	-
221		0.42	0.72		0.05	0.99	0.42			16	II	77
222	SAE 6140, AISI A6145	0.43	0.74	0.23	0.06	0.92		0.16		4	II	78
223	SAE 6150	0.50	0.95	0.19	0.22	1.03		0.20		6	II	79
224	SAE 6150	0.53	0.67			0.93		0.18		4	II	80
225	Austenitized at 1500 & 1925 F	0.87	0.30	0.32				0.27		4	I/III	67/52

INDEX
TABLE-Continued

CHEMICAL COMPOSITION IN PERCENT

	STEEL	C	Mn	Si	Ni	Cr	Mo	W	OTHERS	REFERENCE	TYPE	NO.
226		0.90	0.47	0.42				0.20		12	III	53
227		0.44	1.64	0.06	1.84	1.64	0.40	0.15			IV	50
228		0.35	0.66	0.28	1.58	0.70	0.37			38	III	54
229		0.37	0.66	0.15	2.14	0.74	0.24		V- 0.06	38	III	55
230		0.40	0.83	0.22	1.77	0.57	0.30		V- 0.06	38	III	56
231		0.22	0.35	0.27	2.74	0.80	0.37		V- 0.09	38	III	57
232		0.37	0.76	0.57	0.52	0.90	0.21		V- 0.10	38	III	58
233		2.25				11.5	0.80		V-0.20	26	IV	51
234		0.40		1.05		5.00	1.35		V-0.35	26	IV	52
235		0.55				3.90	0.45		V-0.90	26	IV	53
236		0.85	1.18	0.26		0.50		0.44		13	I	68
237		0.91	1.21	0.29		0.55		0.49		6	I	69
238	W D 74100 fast finishing	1.32	0.28	0.50		0.22		3.52		13.6	I	70
239	N E 8442	0.39	1.58	0.27	0.05	0.16	0.44			23	III	59
240		0.40	1.43	0.22	0.23	0.29	0.32			6	IV	60
241		0.43	1.65				0.36			32	III	61
242	N E 8620, 8720	0.18	0.79	0.31	0.52	0.56	0.19			53	II	81
243	N E 8630 (see Addenda)	0.33	0.87	0.28	0.48	0.50	0.20			23	II	82
244	N E 8630	0.30	0.91	0.32	0.61	0.52	0.17		Cu 0.06	2	II	83
245	N E 8630, continuous cooling	0.31	0.94	0.26	0.53	0.59	0.21			32	-	-
246	N E 8640, "8740"	0.42	0.89	0.30	0.58	0.52	0.24			23	IV	62
247	N E 8642	0.42	0.85	0.29	0.50	0.51	0.23			23	III	63
248	N E 8642	0.44	0.90		0.45	0.54	0.22			4	II	84
249	N E 8749	0.52	0.85	0.21	0.53	0.50	0.26			6	II	85
250	N E 8949, 9550	0.52	1.19		0.53	0.51	0.35			4	III	64
251	N E 8949	0.49	1.01	0.20	0.54	0.56	0.38			6	III	65
252	N E 9420, (see Addenda)	0.24	0.94	0.47	0.30	0.34	0.14			53	II	86
253	N E 9440	0.38	1.08	0.70	0.34	0.40	0.11		Zr-0.030	4	II	87
254	N E 9540	0.38	1.45	0.66	0.57	0.52	0.19		Zr-0.015	4	III	66
255	N E 9642	0.39	1.44	0.56	0.06	0.53	0.0		Zr-0.020	4	II	88
256	N E 9650	0.48	1.30		0.06	0.54	0.01		Zr-0.025	4	II	89
257		0.45	0.73	0.21	0.30	0.15	0.47		V-0.13	38	I	71
258		0.30	1.52		1.11	0.66	0.55			46	IV	54
259		0.30	2.02		1.11	0.66	0.55			46	I	72
260		0.33	1.49		2.07	0.67	0.50			46	III	67
261		0.33	1.49		2.07	0.67	0.95			46	III	68
262		0.31	2.02		1.80	0.66	0.55			46	II	90
263		0.25	1.49		2.05	0.69	0.54			46	II	91
264		0.25	1.49		3.99	0.69	0.54			46	II	92
265		0.25	1.38	1.30	1.78	0.09	0.39			26	III	69
266		0.32	0.64		<0.10				Cu-1.14	16	I	73
267		0.60	0.75	1.90		0.25	0.30			26	III	70
268		0.50				1.25		2.75	V-0.20	26	III	71
269		0.55	0.52					1.96		15	III	72
270		0.47	0.28	0.69	0.08	1.16	0.06	2.50	V-0.15	54	IV	55
271		0.29	1.70	1.11	0.10	0.01	0.13			23	II	93
272	Cast Irons	2.49	0.82	2.56	0.06		0.04			55	III	73
273					1.12		0.10			55	III	74
274		2.55		2.55	1.09		0.26			55	III	75
275		2.58	0.81	2.55	1.02		0.53			55	III	76
276		2.51	0.82	2.66	2.06		0.52			55	III	77
277		2.50	0.81	2.58	3.06		0.51			55	III	78
278		2.52	0.85	2.61	4.07		0.53			55	III	79
279		2.52	0.85	2.56	5.11		0.51			55	III	80
280		2.41	0.80	2.48	1.10		0.91			55	III	81
281		2.53	0.89	2.55	2.03		1.22			55	III	82
282		2.56	0.88	2.55	3.06		1.02			55	III	83
283		2.54	0.91	2.62	4.04		1.05			55	III	84
284		2.53	0.93	2.58	5.02		1.01			55	III	85
285		0.32	0.35	0.95		4.86	1.45	1.29		13.26	IV	56+57
286		0.80				3.75	8.70	1.55	1.15 V	26	IV	58
287		0.40		1.15		5.25		4.25		26	IV	59
288		0.85				4.0	8.0	1.90		26	IV	60
289		0.83	0.32	0.25		3.89	4.30	5.79	1.30 V	13	IV	61
290		0.81	0.24	0.26		4.10	4.69	5.95	1.64 V	56	IV	62

INDEX TABLE-Continued

CHEMICAL COMPOSITION IN PERCENT

NO.	STEEL	C.	Mn	Si	Ni	Cr	Mo	W	OTHERS	REFERENCE	TYPE	NO.
291		0.82	0.26	0.28		4.14	3.69	5.59	V-1.56	6	IV	63
292		0.80	0.23	0.27		4.07	6.09	5.70	V-1.65	57	IV	64
293		0.83				4.15	5.00	6.40	V-1.90	23	IV	65
294		0.54	0.62	0.93		7.83		6.90		6	IV	66
295		0.81	0.41	0.31		4.11	4.29	5.46	V-1.51 Co-5.22	13	IV	67
296		0.28				3.25		9.00	V-0.25	26	IV	68
297	High speed steel	0.80				4.00	0.75	14.00	V-2.00 Co-5.00	26	IV	69
298		0.72	0.23	0.43		4.04		18.38	V-1.24 Co-4.72	13	IV	70
299		0.71	0.26	0.32		4.04		18.09	V-1.13	6	IV	71
300		0.72	0.27	0.38		4.09		18.58	V-1.25	13	IV	72
301		0.73	0.21	0.33		4.39	0.18	17.80	V-1.09	56	IV	73
302		0.85				4.0	0.75	18.5	V-2.10	26	IV	74
303		0.75				4.0	0.75	18.0	V-1.15 Co-5.0	26	IV	75
304		0.95	0.48						Co-0.95	8	IV	76
305		0.98	0.49						Co-1.98	8	IV	77
306		0.04	0.13	0.10				17.76	Co-29.50	58	IV	78
307		0.04	0.13	0.10		1.85		17.21	Co-29.30	58	IV	79
308		0.04	0.17	0.13		2.76		17.33	Co-29.10	58	IV	80
ADDENDA												
309	SAE 2330 (Normal Phos.) 0.04%)	0.30	0.78	0.47	3.65					62	I	74-77
310	SAE 2330 (Low Phos.) 0.01%	0.30	0.80	0.48	3.49					62	I/III	78-9/86-7
311	SAE 5130 (Normal Phos)	0.30	0.80	0.45		0.92				62	II	94-97
312	SAE 5130 (Low Phos)	0.30	0.77	0.47		1.01				62	II	98-101
313		0.83	0.82	0.28	0.34	1.13	0.05			63	II	102
314	Tool steel	0.50	0.35	1.00	0.19	0.11	0.50			19	II	103
315	Tool steel	0.72	0.35	0.23	1.75	0.94				19	III	88
316	Austenite Transformation	0.75	0.50	0.27						64	I	80
317	Within martensite	1.13	0.59	0.24						64	I	81
318	Range	1.35	0.55	0.28	3.56					64	I	82
319		1.12	0.51	0.24	5.36					64	I	83
320		1.35	0.52	0.28						64	I	84
321	Aluminum Bronze								Cu-88.07, Al 11.89	65	I	85
322	Cr-Mo steel	0.31	0.46	0.26	0.26	2.08	0.48			66	II	104
323	Ni-Cr-Mo steel	0.35	0.43	0.25	2.52	1.55	0.53			67	IV	81
324	NAX 9130X	0.32	0.77	0.97		0.66			Zr-0.15	68	II	105
325	SAE 2340	0.40	0.89		3.34					23	III	89
326	#3240	0.43	0.52		1.76	1.19				23	III	90
327	3435	0.34	0.64		3.27	0.76				23	III	91
328	Ni-Mo- V steel	0.34	0.71		2.52		0.42		V-.02	23	III	92
329	# 4330 and V.	0.32	0.72		1.70	0.82	0.31		V-0.17	23	III	93
330	X 4130	0.29	0.58	0.29	0.31	0.85	0.18			69		
331	N E 8630 welding data	0.31	1.07	0.11	0.32	0.26	0.12		Cu-0.07	69		
332	N E 9430	0.30	0.91	0.32	0.61	0.52	0.17		Cu-0.06	69		
333	SAE 6115 continuous cooling	0.16	0.85	0.34		0.92			V-0.15	70		
334		1.3				4.3			V-4.2	71	IV	82-4
335		1.3				4.2	1.2		V-4.2	71	IV	85-87
336		1.2				4.3	2.2		V-4.2	71	IV	88
337		1.3				4.3	3.2		V 4.2	71	IV	89-91
338	unstressed and stressed(1.5xyield)	0.26	0.62	0.72	0.32	5.17	0.46			72	IV	92+93

given temperature for the austenite transformation to go to completion is characteristic for each steel and depends on such factors as the chemical composition, homogeneity, grain size, carbides and others. The end product may be carbides (or spheroidized cementite), ferrite, pearlite, bainite or mixtures of these.

★ ★ ★

NEW processes have been developed using this new data, presented in I-T diagrams, which are a result of exhaustive studies on very small and thin samples of steel. The new heat treating processes are illustrated with actual examples in Figure 5. The names given to some of these treatments are misnomers to which the industry has become accustomed. A change to a more representative name for some of them appears necessary.

★ ★ ★

See Charts Next Two Pages

Part II will be published in the forthcoming FEBRUARY, 1949 issue of WIRE & WIRE PRODUCTS

INDEX TABLE -Continued

No. Steel	C	Mn	Si	Ni	Cr	Mo	OTHERS	Ref. No.
339	0.34	1.33		tr.	0.13	0.03		73 339
340	0.34	1.53		0.06	0.10	0.32		73 340
341	0.33	0.94		0.96	0.19	0.07		73 341
342	0.29	0.29		1.77				74 342
343	0.41	0.73		1.96	0.21	0.31		73 343
344	0.30	0.32		3.02				74 344
345	0.33	0.52		3.00	0.14	nil		73 345
346	0.41	0.72		3.44	0.19	0.02		74 346
347	0.29	0.29		4.21				74 347
348	0.32	0.44			0.56			74 348
349	0.30	0.40			0.81			74 349
350	0.33	0.42			1.80			74 350
351	0.32	0.40			2.76			74 351
352	0.34	0.61			3.24			74 352
353	0.39	0.69			1.16	0.34		73 353
354	0.38	0.53		0.10	1.11	0.42		73 354
355	0.33	0.45		tr	1.08	1.08	Cu-1.09	74 355
356	0.35			1.27	0.55			73 356
357	0.28	0.35		1.15	0.72			74 357
358	0.35	0.61		1.34	0.85	0.033		73 358
359	0.27	0.38		2.02	0.68			74 359
360	0.33	0.39		3.16	0.62			74 360
361	0.35	0.54		2.75	0.96	nil		73 361
362	0.40			2.94	1.00	0.20		73 362
363	0.33			3.00	0.98			73 363
364	0.34	0.39		3.11	1.18			74 364
365	0.28	0.38		2.61	0.69			74 365
366	0.36	0.41		2.12	1.22	0.21		74 366
367	0.18	0.52		3.24	0.67			74 367
368	0.29			3.42	0.70			73 368
369	0.35			3.50	0.79			73 369
370	0.54	0.42		3.22	0.67			74 370
371	1.16	0.42		3.38	0.69			74 371
372	0.34	0.51		4.27	1.35	0.07		73 372
373	0.30	0.38		4.85	0.63			74 373
374	2.34	0.32	0.30	tr.?	11.7			75 374
375	0.49	0.30	0.25	1.41	0.70	0.42		75 375
376	0.93	1.10	0.22		1.20		W-1.70	75 376
377	0.31	0.21	0.31		2.53		W-8.40;V-0.33	75 377
378	0.70	0.36	0.34		3.90		W-17.5	75 378
379	0.70				4.34		W-18.5;V-.50	76 379
380	0.35				2.55		W-7.70;V-0.37	76 380
381	0.90	0.90			0 93		W-1.27	76 381
382	1.09				1.54			76 382
383	0.40			3.50	1.10			76 383
384	0.22			4.18	1.42		W-0.92	76 384
385	1.05	1.	1.4		11-13		V-2.1-2.5	77 385
386	.95-1.1				1.3-1.6			77 386
387	.2-.3	.4-.7			.8-1.	.4-.6		77 387
388	.2-.3	.4-.7			.8-1.1	.15-.25		77 388
389	.3-.4	.8-1.1			.8-1.05			77 389
390	1.45-1.7				11-12.5	.5-.8		77 390
391	1.0	0.3	0.2					78 391
392	0.4	0.4	0.3	2.6	1.1			78 392
393	0.6			3.2	2.3			78 393
394	0.3	0.5	0.3	3.2	0.8			78 394
395	0.5	0.6	0.2	3.2	0.7	0.2		78 395
396	0.9	1.2	0.2		0.5		W-0.5; V-o.1	78 396
397	0.8	0.3	0.3		4.6	0.9	W-18.4;Co-10.7 V-1.9	78 397
398	.3-.4			0.4	12-14			78 398
399	0.7				1.3-.65		W-18 ; V-1	78 399
400	0.31	0.46	0.26	0.26	2.08	0.48		79 400

* Note:— 400 see appendix for additional analyses. (Part III)

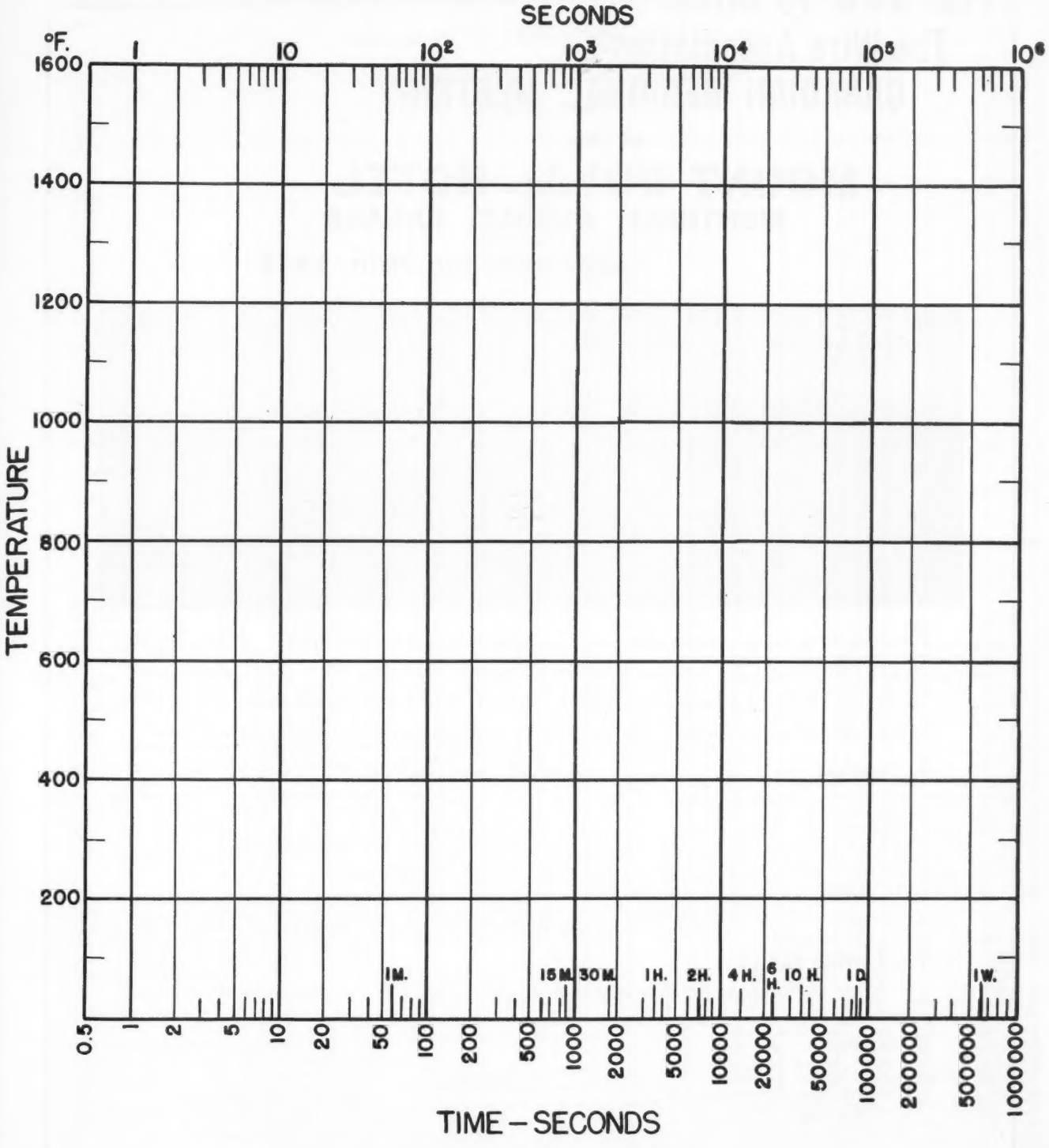


Fig. 6. WORK SHEET FOR TEMPERATURE—TIME TRANSFORMATION DIAGRAMS

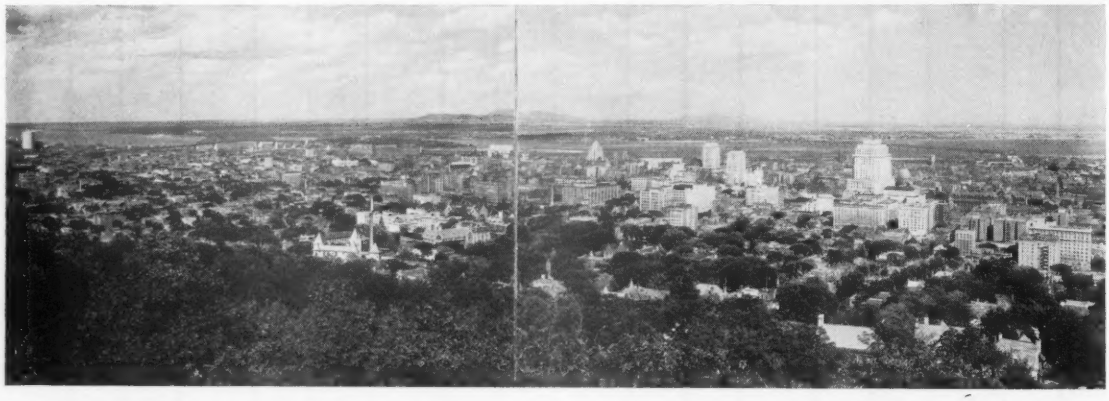
Plan NOW To Attend
The Wire Association's
CANADIAN REGIONAL MEETING

at the

MOUNT ROYAL HOTEL

MONTREAL, QUEBEC, CANADA

April 28th and 29th, 1949



For the first time—a meeting in Canada's largest metropolis. Plans have been completed for a new kind of Regional Meeting with plant visits and technical sessions of **equal interest to ferrous and non-ferrous** users and manufacturers of wire. United States visitors are specially invited to attend.

Remember —

April 28 — Registration (9 A.M.-10 A.M.)
Plant Visit—ferrous
Lunch
Plant Visit—non-ferrous
Dinner and
Entertainment—**Ladies Invited**

April 29 — Technical Sessions

For Further Details:

You will receive hotel reservation cards by mail. If you require further information, contact Wire Association Headquarters or the Canadian Regional Meeting Committee:

Chairman:
A. B. DOVE, P.O. Box 460
Montreal, PQ, Canada

Secretary:
H. MILLER, Wks. Manager
Northern Electric Company
Montreal, PQ, Canada

THE WIRE ASSOCIATION

Richard E. Brown, Executive Secretary
300 MAIN STREET STAMFORD, CONN.

WIRE ASSOCIATION PROCEEDINGS

Discussions of Papers Presented at the Wire Association Annual Convention

Pittsburgh, Pa., October 18-22, 1948

Meeting, Monday, October 18, 1948 — 2:00 P.M.

A. M. Reeder
Metallurgical Engineer
Jones & Laughlin Steel Corp.
Pittsburgh, Pa.
Chairman of Meeting

PAPER: "Practical Development of Modern Wire Drawing Compounds"	by E. L. H. Bastian, Staff Engineer	Shell Oil Company New York, N. Y.
PAPER: "Fumes and Ventilation in the Wire Mill"	by Wallace G. Imhoff, President	The Wallace G. Imhoff Company, Los Angeles, Cal.
PAPER: "Practical Applications and Mill Practice with Carbide Dies"	by E. T. Miller, Die Service Engineer	Firth Sterling Steel & Carbide Corp. McKeesport, Pa.

"Practical Development of Modern Wire Drawing Compounds".

by E. L. H. Bastian

Mr. Crewe: As Chairman of the Program Committee of the Nineteenth Convention of the Wire Association, it is my distinct pleasure to bang the gong to open the Convention.

★ ★ ★

We have a lot of fine papers arranged. I am sure you are going to enjoy them. The time involved for some of these papers is limited, because we tried to work as much as three into some of the sessions, so in order to get started, that you may have a peek at this fine program which has been arranged, I am turning the meeting over to the Chairman of the day, Mr. A. M. Reeder of Jones and Laughlin Steel Corporation. Mr. Reeder.

★ ★ ★

Mr. Reeder: Mr. Chairman, members of the Wire Association, it is my great pleasure to introduce the President of the Wire Association, Mr. Seymour, who will open up with some words of introduction. (Applause.)

★ ★ ★

Mr. Seymour: I am not going to encroach on the time that we have this afternoon for these fine papers which the Program Committee has arranged, except to welcome you to this, our Nineteenth Convention, which has all the appearances of being the finest we have ever had.

★ ★ ★

We have all watched this organization grow from an infant to its present day size. It has been improving as we went along, and I hope we can still continue to improve it.

We want to try to get as much out of this meeting as we possibly can, and I feel that we only get out what we put into it. If the people on the floor will ask the questions, we will have the speakers do their best to answer them. A good, lively discussion oftentimes develops more information and a better understanding of the subject than the paper which is given by the author.

★ ★ ★

I wish you would stand and speak clearly, and as loudly as you can. Give your name to the secretary, so that after the discussion has been typed up it will be sent to you for your own editing, after which your name will no longer appear in the discussion—after it is amended. The only reason we want your name is so that we can send it to you, so that if we didn't get it down just the way you said — either the question or the answer—you will have an opportunity to edit it and correct it as you see fit, after which your name will be deleted when it is printed.

★ ★ ★

I hope that you will enjoy this Convention, that you will enter into the spirit of it, and with a full discussion it should be the most successful one we have ever had. Thank you.

★ ★ ★

Mr. Reeder: This afternoon we have on the program three very interesting papers, and three very good speakers. The first paper is on the subject, "Practical Development of Modern Wire Drawing Compounds," by Mr. E. L. H. Bastian, Staff Engineer, Shell Oil Company, New York City. Mr. Bastian.

★ ★ ★

Mr. Bastian: Mr. Chairman, I appreciate, and am honored to have, this opportunity to address this group this afternoon on the subject of "The Practical Development of Modern Wire Drawing Compounds."

★ ★ ★

(At this point, Mr. Bastian gave his talk on "The Practical Development of Modern Wire Drawing Compounds.")

Mr. Reeder: Thank you, Mr. Bastian for your interesting paper. The meeting is now open for discussion of the paper on wire drawing lubricants. I am sure that there must be a good many pertinent questions that you must have on a vital subject of this kind. I see a good many wire mill operating people present, and manufacturers of wire drawing compounds and, certainly, there must be some specific questions you have to raise, and I am sure Mr. Bastian will try to answer them. Will you please give your name and company affiliation when you answer.

★ ★ ★

A Member: What type of compound is recommended for drawing copper wire?

Mr. Bastian: Generally speaking, in drawing copper wire one uses a compound which contains a very low free fatty acid, less than .5, or .7 per cent, in order to minimize the formation of green copper soaps. The compound usually contains soap and fat and, dependent upon the size of wire that is drawn and the speed of operation, will depend the relation of soap to fat proportion contained in the compound. For rod breakdown and intermediate wire drawing, the same type of compound may be used, and usually contains relatively high free fat, but of a type that does not include high free fatty acid.

In the case of fine copper wire drawing, it is desirable to use as high a soap

concentration as possible, short of reaching a point of excessive foaming, and to maintain only the necessary amount of fatty oils or fats to provide adequate lubrication. Excessive fats or fatty oils in fine copper wire compound tend to give sticky wire and wrapping. Does that answer your question?

A Member: Yes. What type of compound is recommended for drawing of intermediate size wire from a rod down to fourteen gauge?

Mr. Bastian: I will try to explain that in a general way. That type of compound—

A Member: (Interposing) We have different ones for heavier wire. You have got to use more fat, and as you go down to the finer size it keeps dropping off, but is there any established medium of just how much fat soap you use in the commercial compound for the drawing of copper wire?

Mr. Bastian: You use the same compound for intermediate wire that you use for rod breakdown. That compound will contain both soaps and fats, and I presume you speak of a wet wire system?

A Member: That's right.

Mr. Bastian: You would use an emulsion in that case, and for rod breakdown a heavier concentration. You use on the order of four or five per cent concentration of soap fat solids for rod breakdown and two to three per cent concentration for intermediate wire, but you use the same type of compound. That compound would contain approximately, in a neat form, equal parts of soap of a suitable type and a fat of a low free fatty acid composition.

A Member: How do you go about making that fat and soap content solution?

Mr. Bastian: The compound as delivered to your mill, of course, would be in a paste form.

A Member: That's right.

Mr. Bastian: You would mix it with water, and as I mentioned in the discussion previously, by the use of hot water at a temperature of one hundred and fifty, one hundred and sixty degrees, and mechanical agitation get a thorough mixture, a homogeneous emulsion.

A Member: Every time you add mixture to it, it seems to break up.

Mr. Bastian: You have poor emulsion stability.

A Member: That's right.

Mr. Bastian: That would indicate the need for either a higher soap content or the use of a different type of soap in order to give you a better mixture of the water with the compound.

A Member: Do you have a little circular or something on that I could use? Do you have some sort of instructions on what could be used to strike a balance?

Mr. Bastian: I would refer that problem to your supplier of the compound.

A Member: We have tried a lot of suppliers, and they all swore up and down if you bought a certain compound it is good, and it is absolutely no good. It is just like drawing copper through water. Our die life is very low.

Mr. Bastian: I would be very happy to discuss your problems with you individually after the meeting, if you prefer.

A Member: In the drawing of aluminum wire, has there been any work on using a tin coating on aluminum wire as a lubricant?

Mr. Bastian: In reply to your question, I am sorry, we have had no experience on the tin coating of aluminum to speak of. I can't comment on it.

Mr. Reeder: Any other questions?

A Member: On Page 893 you made a statement that by using diamond dies you get twenty per cent better surface finish. I was wondering what sort of standard you use to make your surface finish comparison.

Mr. Bastian: That comment was included as a part of the report we had from the user. I do not have access to the details of the scale by which they evaluated that. We used that as received from the plant laboratory. I could secure that and supply it to you individually.

Mr. Reeder: I have a question, Mr. Bastian. Do you have any specific information on dry drawing and wet drawing lubricants for drawing of nickel plated wire—nickel plated coat, as on steel wire?

Mr. Bastian: And the type of solutions that would be used?

Mr. Reeder: Yes,—the dry drawing soap, and also wet lubricants. Anything specific on that?

Mr. Bastian: We have had some experience with emulsions used for that purpose, and they seemed to be reasonably satisfactory. You had in mind the relative merits of emulsions against dry soap compounds?

Mr. Reeder: A good lubricant for dry drawing of large sizes of plated wire—nickel plated—and in the fine drawing a lubricant for the wet drawing of the nickel plated wire.

Mr. Bastian: Our experience in that has been in the use of types of compounds similar to those for drawing bright wire. Those would be types of paste compounds containing soaps, usually sodium potassium soaps, free fats, and water, made into a slurry for use in wet drawing. My company does not market the dry soap type of lubricant, so of course our experience in that is not direct. It is only by observation.

Mr. Reeder: Any other questions?

A Member: You mentioned drawing bright stainless, three-sixteenths diameter. I imagine you are figuring on one pass. Do you ever get two or three passes on bright stock annealed wire? Have you any lubricant that would stand up for more than one pass—stainless 302, 304?

Mr. Bastian: The use we have observed in such applications is on a basis of either one or two passes. I have observed two passes—not more than two passes. You have reference to the work hardening problem?

A Member: Physicals, when you have an eight or ten per cent reduction area. Suppose you have to give thirty-five or forty. You have trouble with your lubricants breaking down. If you try to do it in two passes, you can't draw the second pass at all.

Mr. Bastian: That is quite a problem. We have been looking at that and attempting to do something about it. To my knowledge, the necessity for applying the lubricant for every pass is still the case and intermediate anneals must often be used.

Mr. Reeder: Does someone in the back of the room have a question?

A Member: You mentioned the compound lubricant oil used for aluminum. The chief problem was the pickling of the oil. Do you know of any method that can be used for reclaiming the oil without removing some of the essential compound fatty acids? Do you know if it is possible to reclaim the oil and still have the essential lubricating properties still there; by filtration, or some other method, will you remove the compounding fats?

Mr. Bastian: I suggest if you have merely a concentration of metal fines in oil, these can probably be removed by heating the oil to about 200° Fahrenheit and either centrifuging or filtering through a mechanical filter, such as a metal edge type, or a waste absorbent type. Do not use an active clay or adsorbent type filter, as this kind of filter would very likely remove fatty oil or other fatty compounding if such compound is contained in the oil.

However, if the oil, containing both free fatty acids and metal fines, has thickened up appreciably due to formation of metallic soaps, then the reclamation method I have described may not be suitable. In such a case, it would be desirable to dump the batch, and start over with the lightest viscosity oil with which you find it possible to draw satisfactorily. Does that answer the question?

A Member: Yes. Thank you.

Mr. Reeder: Any other questions? If not, we will move on to the next paper. I am going to take the liberty of reversing the status of the next two papers. I am going to ask for the paper on the "Practical Application and Mill Practice with Carbide Dies," since the die problem seems to fall more in line with the lubricant problem. This paper is to be presented by Mr. E. T. Miller, Die Service Engineer, Firth Sterling Steel and Carbide Corporation, McKeesport, Pennsylvania. Mr. Miller. (Applause.)

TO WIRE MILL MEN

Have you considered joining the Wire Association? You are cordially invited to become a member. Dues are $15.00 a year, which includes a subscription to WIRE & WIRE PRODUCTS and a copy of the Annual Buyers Guide.

300 MAIN STREET THE WIRE ASSOCIATION STAMFORD, CONN.

(At this point, Mr. Miller gave his talk on "Practical Application and Mill Practice with Carbide Dies.)

Mr. Reeder: Thank you, Mr. Miller, for a very interesting paper. The meeting is now open for discussion.

A Member: Back in 1932, there was considerable confusion in the wire and the die industry because there was no standard die, or bell. At that time, the industry was getting on its feet, and I think there were a hundred and fifty-seven different nibs used by the wire die makers. In an effort to standardize, all manufacturers got together and tried to keep their nibs in the ratio of five to eight diameter at that time. The reason was because as the height of the nib increases, it tends toward breaking —the tendency toward breakage went up.

I think Mr. Miller has done an excellent job, but die breakage is the dominant thing in the criticism of the carbide dies. All manufacturers make good dies, but every die breaks sometime or other, and there must be a compromise between die height and utility. I believe we approached it similarly, and we have better than a hundred thousand dies with a deep cored back relief now. We introduced them quietly about two and a half years ago because we did not want to disturb manufacturers' relations. We knew there would be a saving of some twenty per cent in die recutting costs, but we didn't dare publish it. What we took off the back we put on top, but we do not want to encourage the same thing that caused the die manufacturers, in 1932, to establish that five to eight ratio.

As you increase the length of the nib, the die breakage mounts tremendously. I think there is some justification, not for the maintenance of that ratio, but to move away from it cautiously so that die breakage doesn't become greater than the saving made as a result of die recutting savings. I think a good deal of thought ought to be given to that because if you'll notice on that No. 5, where you compared the die heights, the picture of the drawing is misleading, because your extension of your reduction is such that you have raised the frictional area to the point where you can break that die very easily. If those two things were to be taken from the same graph—say five sixty-two down to five hundred—that second die, the bottom one would break. I think the thing should be examined very closely, because you incur more problems.

A Member: I disagree with the gentleman. If you have a certain reduction angle, the wire is going to reduce in proportion to what the reduction angle is. Time and time again we have recut dies. If you have that short nib you have added expense. If you cut that die up higher, you can put in your fourteen, sixteen, twenty, or twenty-two with that nib, and you are saving, I'd say about thirty-five, forty per cent of labor.

Mr. Reeder: Do you have any comments to make?

Mr. Miller: I can appreciate Mr. Clark's statement about this die, but we don't advocate that you go beyond the percentage of reduction—your present percentage of reduction. If you are using thirty per cent reduction now, we think you should continue to use thirty per cent reduction. What I advocate is the die will draw a larger size wire than it would formerly.

A Member: Those two dies are not doing comparable work. If you were to draw fine wire, you could use that lower die, but if you were to use a heavier wire on that you would break it, because you would have a length of about a hundred and twenty-five per cent of the bearing diameter. On fine wire, that is all right, but the larger wire would tend to—

Mr. Miller: (Interposing) That drawing wasn't made to scale.

A Member: It is misleading, in the sense that the comparison is direct but they are not the same thing. One is a fine wire and the other is a standard reduction on a substantial rod.

A Member: When you are drawing wire, the finer wire you get, the longer bearing you have, and as you get down to heavy wire, your bearing is reduced.

A Member: I agree with you, but in the direct comparison, if you would take the same die and move it up and compare the types of drawings, then you would have the same thing. You have a heavy die and a light draft die.

Mr. Miller: The purpose of this drawing is to show the wider angle that is used in this die in an effort to get the reduction angle down further, for the express purpose of having the bell opening at the top to permit your lubrication.

A Member: Suppose you have, say, a half inch rod, drawing from 562. If you use an angle that would permit the reduction over that length I say you would break the die. You would break the die if you used that on a half inch rod. You couldn't have a hundred and twenty-five per cent reduction on steel because the pressure would break that die.

Mr. Miller: I appreciate that. That drawing was not drawn to scale and there is, perhaps, some error in the bearing length as compared with the reduction in length of the reduction angle in the drawing. The drawing is merely made for a contrast, I remember in 1932 we broke an awful lot of dies. We don't have that condition anymore. I mean, we still break dies, and as long as carbide dies are used they will break them, I think that the casing we have on dies today is so superior to the casing used on dies in 1932 that we don't have to be so much concerned about breaking dies.

A Member: If you are reducing a heavier than half inch rod you can't use a sixteen degree angle—you will probably use a twenty-two or twenty-four. You will break it down and have a short bearing.

Mr. Miller: I still maintain we don't encourage increasing the percentage of reduction per hole. What I claim is, that the die which formerly would accommodate, we will say, .133″ wire from .166″ stock—in the old type of die, that would be the limit of it, whereas in the new type die you could draw, probably, .155″ wire from .187″ stock, increasing the value of the die, not as per hole, but per size of wire that can be drawn through that die.

A Member: This has all been fun, as Cain said when he slew Abel, but all I ask is that people don't leave the room and think that the solution to their die problems is going to be in the longer and higher nib. With due respect to every manufacturer, I think you will go through a cycle of die changes and come back very close to where you are. I would agree there is some justification for a slightly higher nib in some cases, but if you will review what happened in the die business just two years ago—most of the standards were revised and the nib shortened. For the man who has to recut dies I see no point in giving him more metal to cut out, because with every addition you have to do more work in the die shop, and it is our objective to remove the metal so there is less work done in the die shop and also to give as much flare as required and no more than required because the die industry gets every day closer and closer to its economic base, and manufacturers will not be able to give more and more methods.

The ratio of that is not in the ratio of five to eight—not that this rule of five to eight is sacrosanct and can't be touched, but the rule of five to eight was built to prevent breakage. The dies, in every instance, have improved. Dies will get better. It has been our experience, based on a check of three quarters of a million dies, that every carbide die ever made breaks. They all break at one point or another. The objective has been to push that breaking point up. Now, with records extending back as far as 1932, we found in 1932 that the R-5, which was then the standard of the industry, broke at the average point of .98; by 1935, that same die was breaking at about 122; by 1948 the average breaking point was 140, and we have drawn that average breaking point up to 181. We felt that the economies would come from the study of that, rather than to go into adding more metal, because each time more metal was added the tendency to break increased. We see the advantage of a wider flare, but we don't see any advantage in just increasing the breakage, which has been the one thing the industry has sought to reduce. Do you get my slant on it?

Mr. Miller: You said that you agreed that the nib should be increased some in height?

A Member: But cautiously.

Mr. Miller: That is what we have done, we haven't stated yet (unless you could see it on the chart here) how much we increased the height. That is what we have done. We have increased it cautiously in the smaller nibs, where the back relief did not need to be so great as in an R-3. We only increased it enough to permit of a cored back relief without moving the reduction angle up into the die. In other words, you have the same die now with the new high nib, plus a cored back relief, as you had before, as you rework, the die your bearing moves down (not up) in the die, it is still in the same position it was formerly. We haven't changed the working area of the die at all.

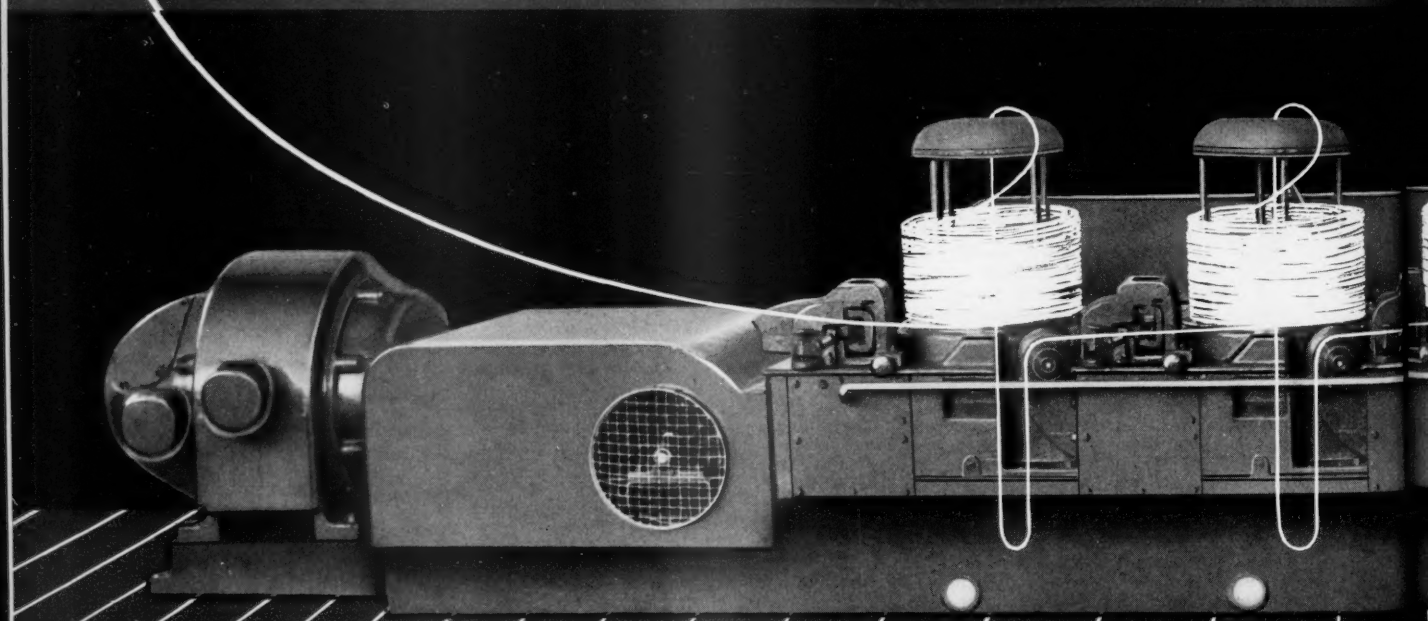
A Member: Since all manufacturers

(*Please turn to page 85*)

Draw it faster, better,
more economically with

Morgan Connor

WIRE MACHINES

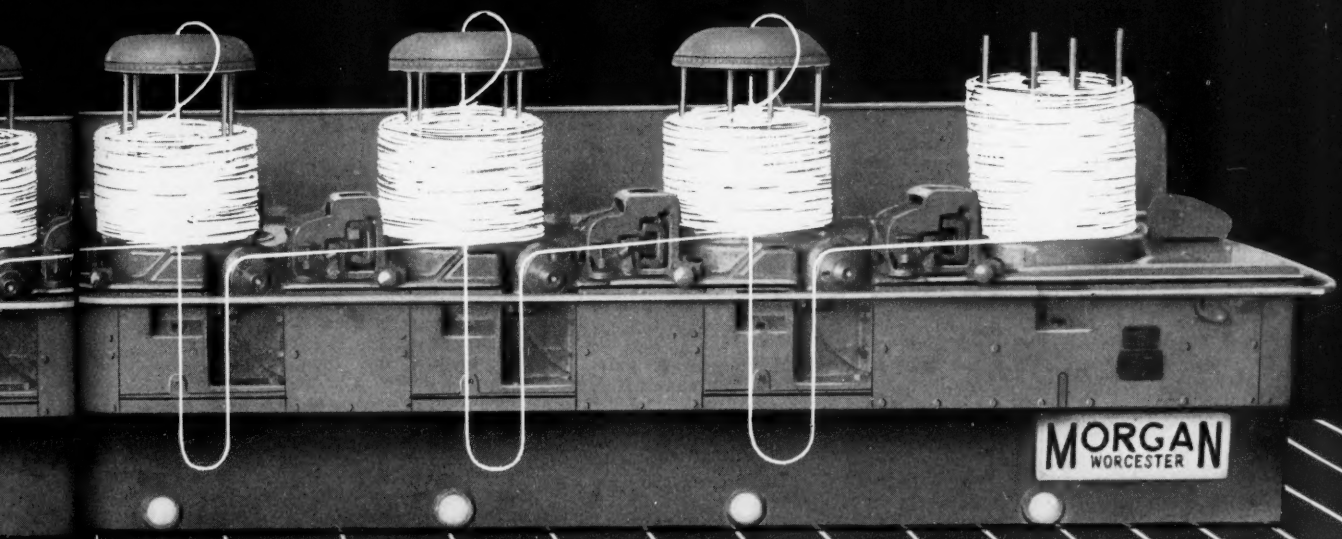


Low Power Cost... Low Die Cost... Lo

1 Operates from single motor
2 Either alternating or direct current
3 Low Maintenance
4 Positively no slip can occur.
Wire uncoils from previous block
5 The lag between drafts gives sufficient time
for adequate cooling
6 Simple, safe and convenient to operate

Morgan Construction Co.
WORCESTER, MASS.

WM-22



pace Requirement...High Production

(At this point, Mr. Imhoff gave his talk on "Fumes and Ventilation in the Wire Mill.")

Mr. Imhoff: If there are any questions I will try to answer them. As I mentioned in the beginning of my paper, the main thing is to consider each problem. I have tried it in many, many, many plants over the last twenty-five years. You cannot solve the problem with one general solution. Each individual plant has to have its own careful study. Now, if there are any questions I will do my best to answer them.

I was particularly interested just a short time ago in going into a plant in Los Angeles. It happened to be a galvanizing plant. It wasn't a wire mill. I was really very much surprised to see how efficiently they took the fumes out of the plant. A very important consideration of any kind of engineering is what kind of materials you are going to use. Well, as you know, acids will quickly destroy steel. They will corrode almost anything in time, any kind of machinery working around them—the vapors. In fact, I remember one plant where the material that was supposed to be galvanized was completely destroyed before it even went through the plant—before it could be galvanized. This plant that I have in mind, I think, illustrates very well two things. It illustrates that wood is by no means an outmoded material for controlling fumes. It also illustrates very, very definitely the engineering problem. These hoods that were over the galvanizing furnaces and pots were made out of wood, and they came down extremely low, so that it was practically an inclosed system. The engineering there was very, very clever. The hoods themselves were low enough so that they were down below the monorails; therefore, the problem of carrying the work back and forth through the hoods had to be considered, so in order to solve that problem they had a door that hung from the top ledge, and when the articles or anything went through on the monorail that door was simply opened, and anything hanging on the monorail could go right straight through the hood. As I say, that is just one problem. Then another friend of mine told me where the fumes from a pickling plant were taken outside of the building—through the side of the building—and the fumes blew against the building. The whole side of the building was eventually very, very badly corroded. The example I gave you in my paper was up in New York, and I actually saw that. The plant was located on the wrong side of the town. In other words, the plant was located on the west side of the town, and the town was over here, so that when the west wind came along all the hydrofluoric acid fumes were blown directly over the whole town. You can believe it or not, but there wasn't a single west window in that town that wasn't frosted like an electric bulb, and the office of the plant itself was almost three blocks away, so that merely illustrates the outside conditions of fumes and the problem that it is to control them so that they don't destroy outside property.

I would like to tell you about another place that I was in. I was in the Galvanizing Department in this plant and the Superintendent had gone out to lunch. While I was sitting there, a number of the men who were working in the plant came in and said to me, "Mr. Imhoff, wouldn't you see if you could please do something about these fume conditions here?" One man pulled up his sleeve—now, this is only a short time ago, during the war period—he pulled up his sleeve and the whole side of his arm was covered with scabs. Another one pulled open his shirt, and his whole chest was one scab. Another man pulled up his pants leg, and all the side of his leg was nothing but scabs. What happened in that plant was that they had tried to solve their fume problems by putting the ventilators up in the roof. That is like trying to live in your furnace, down in the cellar, because the fumes in the plants from the galvanizing and pickling were so heavy that when they began to perspire those acid fumes, along with the sweat and moisture attacked the skin and made it itch. Well, the boys would scratch themselves and the first thing you know they would be infected in one spot, and gradually it spread all over them, and the same was true of the man with the bad arm, and the one with the bad leg, so that illustrates it is a combination of fumes, along with the acid vapors and the moisture—it is that combination, when they are wringing wet with sweat around the furnaces, that has a tendency to bring about infection.

I was in another plant in Cincinnati where a man was working on a pickling tank. That was a good many years ago, but that fellow was covered with what was called "pickle sores." They were enormous carbuncles that came out all over his arms from the fumes, acids, and infection.

If there is anything you care to ask, any point, maybe we can bring out some point I haven't mentioned.

A Member: Do you know of any solution of fumes from gasoline motor equipment?

Mr. Imhoff: Do you mean moving equipment?

A Member: That's right.

Mr. Imhoff: Well, in that case, the only thing I could recommend—I had charge of the Airplane Motor Division in the last war. I had charge of the Engine Department. I don't know whether you use Diesel engines or not.

A Member: No. Gasoline.

Mr. Imhoff: Well, of course, the only thing there could be, maybe, the proper adjustment of the carburetors. That is an extremely important thing—to get the gases fully burned. Now, as you know, the full, complete combustion of gasoline will give water vapor, and as you have often seen in your automobile. In the chemical changes that take place, you get the formation of water which, in the old days, would rust out your exhaust pipe. In moving equipment, I don't know of anything that you could do, other than have an expert mechanic to take care of your carburetors. That's about all you could do.

A Member: I have never seen any carburetor you didn't get fumes from. As they get older, they get smokey, and we have that in our warehouse and in our plant. I wondered if anything had been done to prevent that.

Mr. Imhoff: You can go out on the street and stand there for less than five minutes and you will see a car come along and white fumes and smoke coming out of the back of the car. That is due to poor rings. The oil is coming out there and burning. There, again, it is a question, instead of carburetor adjustment, it is a question of oil fumes, along with the gasoline fumes. In other words, it would require very close inspection of your engines, to see that your rings are tight and that you are not losing oil, in addition to getting incomplete combustion of the fuel.

A Member: I referred to that. You have no way to ventilate for that? We have even used water mufflers.

Mr. Imhoff: I couldn't suggest anything when it comes to moving equipment. If it wasn't going to move, you could make an enclosed system, and that is the basic starting point of the solution of all fume problems. If you will just remember that—always think of your own home furnace. What would happen if you would drop a piece off the chimney. It wouldn't make any difference whether you opened all the windows in your cellar or not, the whole cellar would become contaminated with smoke. That is what an industrial plant is, only instead of having one furnace you have hundreds of furnaces. You have pickling tanks, annealing furnaces, and other furnaces. One furnace is throwing out acid fumes, another heat and another a different kind of fumes. When the thing is stationary, the starting point of the solution to the problem is to be sure that you have an enclosed system, and that is where real tough engineering comes in sometimes—to try to keep that system like the furnace in your cellar, so that there is absolutely no opening. To try to keep your production moving with a closed system is a very, very different engineering problem. If you have cranes or something that is going to hinder the upward removal of fumes—pipes or things like that—then instead of going up you have to turn to downward ventilation. You have to put hoods around the tanks and draw your fumes down, so that your cranes will be free to move above. There are really three systems. There is the enclosed type which, as I mentioned, was entirely closed, as in your strip mills; then there is the side ventilation, that you see on galvanizing furnaces, where they bring the pipes down and have a slight opening—maybe four to six inches—and the galvanizing fumes, the pot fumes are sucked off the bath and taken up the pipe; then you have all around suction, like you have in the wooden ducts for pickling and plating plants; and then, of course, there is the forced system, where you get the straight hood that goes out the roof, and is enclosed all over.

In one particular plant they had some large, open fans, in addition to a large umbrella fan up on the roof. They put in three or four more fans, and when we came into the galvanizing room after the fans had been put in, every one of

(*Please turn to page* 87)

TUESDAY, OCTOBER 19, 1948 — 10:30 A.M.

J. K. Findley
Metallurgist
Allegheny Ludlum Steel Company
Dunkirk, N. Y.

Chairman of Meeting

PAPER:
"The Control and Production of High Carbon Wire" — by Jerry G. Weiss, Supt., Patent and High Carbon Wire Dept. — Keystone Steel & Wire Company, Peoria, Illinois

PAPER:
"Evaluation of Pickling Inhibitors from the Standpoint of Hydrogen Embrittlement" — by Carl A. Zapffe, Consulting Metallurgist and M. E. Haslem, Research Chemist — Baltimore, Md.

"The Control & Production of High Carbon Wire" — by Jerry G. Weiss

Mr. Crewe: Good morning, ladies and gentlemen. I am delighted to see so many of you are able to be here. There was a very fine representation yesterday and also much activity last night, which might have kept a few of you away, but it is fine to see you here. Even Johnny Moritz is here, so I am sure most anyone is able to be around.

I give you your Chairman of the morning session, Mr. J. K. Findley, of the Allegheny Ludlum Steel Company, Mr. Findley.

Mr. Findley: Thank you. This morning we will have two papers. The first will be by Jerry G. Weiss, Keystone Steel and Wire Company, on "The Control and Production of High Carbon Wire." Jerry has been with Keystone about twenty-one years, a fair part of that time as Chief Inspector, and then he went into production, so I think he knows whereof he speaks.

We are going to have to limit the paper and the discussion to not over and hour each because we must finish at twelve o'clock. Mr. Weiss.

Mr. Weiss: Mr. Chairman, members and guests of the Wire Association. I have been reminded several times we must watch the time. That reminds me of a story I heard. A man took his little boy, who was quite inquisitive, to a political meeting. The speaker came up to the rostrum and waved everybody to their feet. The little boy said, "What does he mean, Dad?" He said, "Well, he means we are going to rise and sing a song." So after the song was finished the politician waved again. The boy said, "What does he mean now, Dad?" He said, "Well, he means for the ushers to come down and take up a collection." So then the politician cleared his throat and took out his watch and wound it, and laid it down. The boy said, "What does that mean, Dad," His father said, "Son, that doesn't mean a darn thing." So we will try to keep the thing within bounds.

I also heard of a preacher, or read of one, who said that he who talks too long proves nothing. I am not going to try to prove anything, but I am going to try to take you on a little trip through our plant so you might know what we do there.

(At this point, Mr. Weiss gave his talk on "The Control and Production of High Carbon Wire.")

Mr. Findley: Thank you. I know it is difficult to condense such a large subject into a few minutes' talk, but I think Jerry has done an admirable job, and I know there must be some questions. There are bound to be when you try to cover so much in so little time.

Who will open the discussion?

A Member: You spoke of the danger of allowing wire to stop in the patenting furnace. I presume you weld rods in. Does that weld ever break when it goes over pulleys?

Mr. Weiss: Many times.

A Member: The trick is to get it back on as quickly as possible?

Mr. Weiss: That's right.

A Member: I wondered if anybody had a method of keeping them from breaking?

Mr. Weiss: We don't have many of them break. On the large rods, in fact, the boys try to break them; then they don't have to cut them.

A Member: What method have you to get that break on the block very quickly? We mostly have colored boys doing that and they are not very quick at getting the rod back on the block.

Mr. Weiss: Our breakage occurs right at the take-up frame.

A Member: We have it right at the pulley.

Mr. Weiss: They take it off the pulley, and then get a long length out and thread it back on. It really only takes a few seconds—at least, the way they do it. I never actually tried it myself.

A Member: It is just a matter of training?

Mr. Weiss: I think so.

A Member: You mentioned that the 360 degree twist test on the ends of the coils is used to check the coils or rods. Do you consider that sufficient to give you a true picture of the rods throughout the coils? In other words, our experience has been that it will be sometimes intermittent. How do you cope with a situation such as that?

Mr. Weiss: You have to take it. You can't test it only on the ends, unless you want to make a lot of ends. It is true you sometimes have an intermittent condition such as seams or laps. You can't do anything about that. That occurs in rod mills and there isn't anyway, really to find out.

A Member: What I mean is, do you think that is sufficient—that test—or do you think it is worth the cost to portray what that represents of the coil throughout? I don't, frankly speaking. It is an overall picture, yes, but not individual.

Mr. Weiss: What do you do? Do you just go ahead and run everything and then take the rejects?

A Member: We pickle test a certain percentage of the coils, and get a picture from that operation.

Mr. Weiss: You are pickle testing the ends?

A Member: Right.

Mr. Weiss: We pickle, oh yes—then etch in a very strong acid. I think they are using a solution of nitric and sulphuric.

A Member: Is every coil checked as such?

Mr. Weiss: Yes, every coil.

A Member: You made reference to comparative costs of electric patenting versus furnace patenting. I don't think that cost comparison can be drawn as between your regular furnace patenting and your large machine, is that true?

Mr. Weiss: I believe that is true.

A Member: Actually, what you should have is a larger group of small machines.

Mr. Weiss: I have given the picture as we have it in our plant.

A Member: On small lot orders, a few thousand pounds will take a few minutes.

Mr. Weiss: That is right. He mentioned the cost. It might interest you to know that I did mention the cost rate of our regular gas fired furnace as compared with Mr. Zur's electric patenting. It is about twice as much according to my figures, and I am sure they are right. We should have more smaller ones, I suppose.

In the case of oil, when there is a shortage of gas, oil costs are over five times as much—about five and a half times as much.

A Member: When you were talking about patenting all high carbon rods before ripping: Where do you stop? Say you take forty, fifty—do you patent that before you rip it?

Mr. Weiss: Yes.

A Member: That is a lot different from the way we used to do.

A Member: On your chart here I notice, on your hardenability values, you take only the manganese and carbon. How about your other things, your silica and so on?

Mr. Weiss: Residual alloys, of course, will affect your physical properties, particularly as they go up. Nickel and chromium and tin, of course, are all hardening elements, and your strength will go up very, very fast. However, there is one redeeming feature, partic-

(*Please turn to page* 89)

(At this point, Dr. Zapffe gave his talk on "The Evaluation of Pickling Inhibitors from the Standpoint of Hydrogen Embrittlement.")

Mr. Findley: Thank you, Dr. Zapffe. That was very interesting. I have only had the pleasure of reading the first paper. The types of curves, I believe, require quite a little study to fully understand just what goes on. I think I should say there is a lot you may not care to say about the compositions, but nevertheless it would be interesting to know just what the theory back of this is. I am sure there must be questions.

A Member: I would like to ask three questions. First, is there any difference when you use killed steels for these tests; second, how does agitation affect the absorption of hydrogen; and the third question is, what effect does baking after pickling have, so far as the hydrogen absorption is concerned?

Dr. Zapffe: There is quite a bit of difference in the type of steel that you use; and a great deal depends upon the heat treatment. In papers previously published in Wire and Wire Products we cover these points; and you will find there that carbon is a great promoter of sensitivity so long as the condition is martensitic. Hardened steels become more sensitive to hydrogen as the carbon content increases. A picture is shown in the Feb. 1946 paper of a surveyor's tape which has to do with an interesting experience of some students at the University of Minnesota. Each spring the third year class goes to the northern iron-ore ranges for practice in surveying. In the red mud often encountered there, it is common to get one's steel tape dirty. Also, a broken tape is a threat; and the cost is a nickel per break. One of the boys brought back a muddy tape, washed it off in a bowl of vinegar, wound it up, and put it on the shelf. The next morning it was broken into one hundred and forty-seven pieces—at five cents a break!

Certain spring steels are extremely sensitive; and one of my introductory points today was to emphasize that steels generally believed by operators to be by their very nature liable to breaking in the die and during coiling may have earned that reputation because of their constantly damaging hydrogen content. Perhaps if you could get that gas out and keep it out you might have much more freedom in working than heretofore believed possible.

On the other hand, when carbon steel is annealed, the carbon comes out of solution and forms carbide. In the plain carbon—the unalloyed steels — that carbide prevents embrittlement. We have been virtually unable to embrittle music wire; and this brings out an interesting difference between spring grades developed by thermal hardening and those by mechanical workhardening. However, with stainless grades, increasing carbon content causes increasing susceptibility, and this whether it is annealed, hardened, or coldworked. No explanation is yet available for this difference between stainless steel and carbon steel.

In ingot iron, the carbon content is so low that one enters another range of phenomena in which it is believed by some that pure iron will not absorb hydrogen. Killed steel presents still further complexities which must be separately considered and are too involved to go into here. Briefly, their behavior depends principally on the content and condition of the carbon, secondarily on the nature of the "Kill."

For your second question, agitation, we made some tests with agitated solutions and found no particular effect. Hydrogen absorption is a very fine-scale surface phenomenon on an atomic basis; and agitation may shake up the evolving molecular H_2, but it need have but little effect on the adsorbing and absorbing atoms.

Your last question concerns baking to drive hydrogen out of the steel. Baking does not drive it all out. Once again you should refer to the series of articles in Wire and Wire Products where we describe how this gas goes into the metal and finds tiny openings within the crystal—the "slip planes"—internal surfaces on which the metal slides when you deform it. These are very thin openings of only atomic dimensions, but large enough to house the tiny hydrogen atoms and molecules. We took, for example, a solid bar of steel and drilled a longitudinal hole in which we sealed a high-pressure gauge. The hydrogen dissolved by this bar during pickling passed through ¼-inch of solid metal, precipitated within the artificial opening, and developed a pressure of 500 psi. when it blew the gasket out. It has also been demonstrated that the gas pressure can proceed to tens of thousands and, theoretically, even to hundreds of thousands of pounds per square inch. There is no steel that can withstand it if the conditions for absorption are advantageous.

To understand the action of the gas within the metal, picture the gas trapped along the same little planes the metal slides on. If the metal has an elastic limit of fifty thousand pounds, once that gas pressure exceeds fifty thousand pounds that metal is strained triaxially so it cannot "slip." The only way it can respond to the deformation is to break, and that is why hydrogen absorption shows as hydrogen embrittlement—a loss of ductility.

Now, if you apply heat to this mass of iron which is in a sense honeycombed with gas pockets, the heat increases the pressure of the gas, and these pockets blow from one to the next until the excess escapes to the surface. Just like little steam blow-off valves in series, the action allows the gas to burst from one to the other and thereby works right out of the grain. We have watched it coming out, and have published pictures in Wire and Wire Products of it coming out. That, then, is what baking does. Now, when you cool the metal down the pressure of the remaining gas reduces to a value which still may be high, but the steel has a higher strength and is not affected. Only a slight difference in the proportional limit remains, because the tiny colloid-size blocks building the grain have been slightly pushed out of position. The entire action is fully explained in the articles referred to.

A Member: The question I asked the first time was the difference between killed and rimmed steel—the method of manufacture. There is a large difference in the surface carbon content.

Dr. Zapffe: In the case of killed steel, the deoxidation of the liquid makes the steel more capable of picking up hydrogen. Your killed steels may therefore be higher in "inherited" hydrogen than otherwise. Rimmed steel loses a lot of its inherited gas during the boiling action at solidification. However, the rim, which is largely carbon free, has special opportunity, perhaps, to absorb hydrogen from the mold wash; and it is not subject to cleansing by boiling, as the center is. In the vitreous enameling industry the rim of rimmed steel shows its own characteristics, being likely to develop a defect known as "fish-scaling," whereas blistering is more likely to occur over the "core" portion. Killed steel and rimmed steel therefore behave somewhat differently with respect to hydrogen. As the member notes, much of the difference can be understood on the basis of the differing carbon content, which is such an extremely important factor in hydrogen problems with steel.

A Member: Did the by-products of pickling in your beakers show any detrimental effect on the hydrogen embrittlement? Were those tests conducted long enough so the tests could be made in the presence of iron sulphate?

Dr. Zapffe: Iron sulphate has been brought to our attention as a factor in embrittlement. We have checked the sulphate and have found no particular effect. Problems with "old" pickling liquors probably do not concern iron sulphates, but rather certain "promoter" elements, particularly sulphur — also phosphorous — which derive from the dissolving steel and accumulate in the bath. After pickling screw-stock, for example, avoid pickling hardenable steels in that bath afterwards. Sulphur leached from the screw stock can multiply by fifteen times the absorption of hydrogen.

A Member: You were speaking of baking the steel after pickling, and as you probably know, we have two methods of baking now—a long bake at a temperature of approximately three hundred degrees for high carbon steel, or a very short bake at approximately six hundred degrees. Would you say one is more efficient than the other?

Dr. Zapffe: Such a comparison is not readily drawn, because the recovery period shortens as you increase the temperature up through the whole range you are talking about. On heating the steel above room temperature, the gas expands in these pockets just discussed and discharges more and more. If you heat to 600°F, there will be much more bursting or escaping power than if you heated to 300°F. The same effect holds up to 1100° or 1200°F, the recovery time decreasing all the way up. At 1100°F, for example, you could remove embrittlement in ten minutes that would take two days to do if the piece lay around the shop. However, above

(*Please turn to page 90*)

WEDNESDAY, OCTOBER 20, 1948 — 10:00 A.M.

Col. Allan B. Dove,
Superintendent Dominion Works
Steel Company of Canada, Ltd.
Lachine, Quebec, Canada.

Chairman of Meeting

PAPER:
"Wear Resistance of Wire for Wire Rope"
by Reginald S. Brown

Chief Metallurgist
With discussion by Geoffrey K. Rylands

Rylands Bros., Ltd.
Warrington, England

PAPER:
"Wire Drawing in the British Iron & Steel Research Association"

by W. Hessenberg,
Head of Mechanical Working Division

British Iron & Steel Research Association
London, W. I., England

"Wear Resistance of Wire for Wire Rope" by Reginald S. Brown

Mr. Crewe: Your Chairman for the morning session is Col. Allan B. Dove of the Steel Company of Canada. Mr. Dove.

Mr. Dove: Gentlemen, I am afraid today is going to smack a little bit of causing or commencing an international situation. We have been very favored this time by having papers and also a good deal of the discussion for the complete morning session, imported, so to speak. The papers this morning are by Mr. W. Hessenberg, who is the Research Director of the Mechanical Working Division of the British Iron & Steel Research Association, and Mr. Reginald S. Brown, Chief Metallurgist of Rylands Brothers, Limited, Warrington, England.

Mr. G. K. Rylands of Rylands Brothers, will cover both of these papers for Mr. Brown and Mr. Hessenberg. I think it would be a good thing if you knew a little bit about Mr. Rylands. He is much more in evidence than I. I have to climb up to this microphone. He will have to climb down!

Mr. Rylands served for a number of years in the Royal Navy, and left in 1919 with the rank of Lieut. Commander, to join the firm of Rylands Brothers, a firm of which he is now General Manager. He is Justice of the Peace of County Cheshire, and any of you who have been in England know that means something. He received the Order of the British Empire in 1936; member of the Board of Directors, Rylands Steel Corporation; member of the British Standard Institution, and Chairman of the Wire Panel, British Iron and Steel Research Association, of which he is still a member. I understand he is known affectionately in Great Britain as G. K., so I will now call on G. K. to carry on with the papers. Mr. Rylands. (Applause.)

Mr. Rylands: Colonel Dove and gentlemen. There must be good intelligence service in this organization. I don't know how Colonel Dove got all that life history. Anyway, it has been produced and here I am. Having had all that said, I do start with a handicap. I have got to apologize for the fact that Mr. Brown is not here to deliver this paper himself, and I think he did the paper last year, and I believe that he presented it very well and he would have presented this one very much better than I can. I have got to apologize for the fact that owing to a variety of circumstances we didn't get this paper in on time to be published in the journal for the meeting, but Mrs. Spengel has managed to get this reprint which, she tells me, arrived at 11:30 p. m. last night, and she spent the small hours of the morning binding it up and getting it ready for which I am very grateful. Mr. Brown and myself have worked together now for a good many years—since 1919, just after the first great war for civilization—and we started more or less together on this job of thinking about wire and making various investigations in the methods of production and so on. In those days, we were not able to do much. The facilities weren't there — instrumentation or anything else. I have always remembered we were somewhat discouraged because we had an Assistant Manager in our steel mill and everytime we started to do anything he used to come along and say, "Of course, they tried that in Sheffield twenty years ago, but it wasn't any good so they didn't do it any more." With that, I began to regard Sheffield as a sort of home of lost causes and wasted opportunity. I used to put forth theories to a great many Sheffield people from time to time.

(At this point, Mr. Rylands gave the talks on "Wear Resistance of Wire for Wire Rope" and "Wire Drawing in the British Iron and Steel Research Association.")

Mr. Rylands: Gentlemen, I hope I haven't taken too long with this rather indifferent summary, and I thank you very much for listening so attentively and not throwing things at me, or anything of that sort. Thank you, gentleman. (Applause.)

Mr. Dove: Now gentlemen, I am sure there will be a number of questions to be brought up. You all have the papers there with you, and Mr. Rylands has given you the main conclusions. I know some people may disagree. Let's have your questions. Rise first, give your name, and then ask your questions and I will repeat the question back so everyone can hear. The meeting is now open for discussion.

A Member: I had the privilege a year ago, approximately, of visiting Mr. Ryland's plant in—where is it?

Mr. Rylands: Warrington.

A Member: And saw a machine which had already done the work described, and I was privileged at that time to see a preview of this paper, and I think Mr. Rylands has been very modest about the whole thing. because I was tremendously impressed, first of all, in his battle with the Production Department, which he just passed over very briefly. My impression was he had a very complete victory in that battle, because they were making their rope wire based on the results of that research work. In other words, he calmly and deliberately tried to find out what the factors were that made a good rope wire and then was successful in completely revising their manufacturing procedures, and with actually making and producing rope wire in service, based on the results of the work. Their rope wire is lead patented, which you saw from this paper. That was one of the major conclusions—that lead patented wire was much better than air patented wire. The high carbon wire is not drawn too much —which was another definite conclusion.

The patenting was very impressive. Of course, it was under a good deal more technical control than any of us are used to. Really what was being done was lead patenting to get as fine a structure as possible. The patenting was done for the micro structure and not for the tensile strength, which is an idea many of us should follow but don't, so that I think what we have heard today is really a very, very valuable contribution to the manufacture of rope wire, and I think we can all well go home and read this paper with a lot of thought, and go back to our plants and do something about it.

Mr. Dove: Mr. Corson, do you have any remarks or comments?

A Member: Well, of course, I am giving a paper tomorrow on the effect or martensite on rope wire, and one or two little details differ from the conclusions in Mr. Rylands' paper, but they really don't pertain to it. They follow along different lines. In his Statement No. 5 there are some differences in martensitic layers. I will talk about that tomorrow.

A Member: Not having seen this paper before, I am absolutely astonished with the amount of work in it. It must have taken months, and possibly years, and then to overcome the resistance of which our friend spoke must have been difficult. When you say tons here, you mean long tons?

Mr. Rylands: Long tons.

A Member: You mean, 2240?

Mr. Rylands: 2240, Yes. We do it that way to make it more difficult.

A Member: I thought that was the reason. What we operations men are

(*Please turn to page* 92)

Mr. Rylands: I guess you've heard that some years ago the British Iron and Steel Research Association was formed and so far as wire drawing is concerned, the process of wire drawing comes under the Mechanical Working Division of the individual Panel of which I am Chairman and of the special committee of which I am also Chairman. Other committees are the Coating, Rolling, Cold Rolling and Forging, and so on. Each of these committees has been charged with drawing up a program of research in its own field, and Mr. Hessenberg is the Director of that research in the Mechanical Work Divisional Panel, and in the paper here he has just given a brief summary of the sort of work which is being done. Most of it is rather obscure. We on the Drawing Committee, for example have the services of very eminent mathematicians who leave me, as Chairman, in a rather unfortunate position, because I am supposed to understand what they are talking about and it is a closed book to me. However, so far I have succeeded, I think, in appearing very wise because they frequently refer to me and ask me what my opinion is. Well, truth to tell, I haven't got one, but I manage to bluff the thing sufficiently to say something which makes them believe I have got an opinion. However, their ideas as to research are really beyond the capacity, or outside of the scope of manufacturers. It is research of a general character which is, perhaps, of no immediate importance in productive processes, but which is knowledge which should be secured—should be covered, and I think the work the Association has done so far has been very good in that way. In this paper Mr. Hessenberg has given you some picture of what is being done and what has been done so far. If there are any questions you want to ask, I can't guarantee to answer them in great detail, but I will do my best.

A Member: I would like to ask to what extent the English people are developing the reactive wire drawing machine. Have you some running in commercial work, or has the whole thing bogged down the way it has in this country?

Mr. Rylands: That is rather a wide question. The machine for reactive wire drawing has been developed by Marshall Richards, and I believe that one, at any rate, was manufactured and was loaned to the British Iron and Steel Research Association in order that they could carry out these experiments which we hoped would be authoritative on reactive wire drawing. The results have been analyzed and will shortly be published in the form of a research paper. I can't say very much about them. I think the conclusion is that the reactive wire drawing does reduce the die load, does give you some small reduction. You do get a small saving in power, but it is very small. It is possible, (I don't know if we have proved this yet) that you do get a prolonged die life. So far as the mechanical parts of the product are concerned, it doesn't seem to make much difference, and my own conclusion is the saving one is likely to get from reactive wire drawing is not worth going across the street to pick up. If you have got reactive wire drawing, it may be convenient to have it. Then you have got the best of both, but personally I don't think it is worth spending a cent to introduce reactive wire drawing for the sake of the advantages you might get from it.

A Member: I have a question. I would like to go back to Mr. Brown's paper. The proof of the pudding is in the testing. If you make a better product, put it out in the field and see how it works out. If it works out, well and good; if it doesn't, forget about it. You say you had these ropes in the field for two or three years? You must be getting longer life from them, and enjoying a reducing business; or else the product is so widely extended in England that you are doing an expanding business. I wondered if you could offer a few comments.

Mr. Rylands: I don't mind reducing business, because there are all sorts of things that control the business. There does seem at the moment to be a very great shortage of ropes, excavators, and that sort of thing, all of which is subject to heavy wear. We have found in many places we have been supplying for years that by producing wire by methods outlined in these papers we have got considerable wear, and the collieries, before they came under public ownership, did express some appreciation. We have supplied excavator ropes both to our own excavators and other companies, and we have found that by modifying the method of production we can get, and we do get, better life. We have also applied the same method to ropes we produce ourselves, to our cleaning house cranes and all the odds and ends of ropes we use around the works, and there again the results have been beneficial, and have confirmed our conclusions in this report. We are in the very favorable position of being able to try all these things. We have got plenty of places where we can send out experimental lots and get a report on them.

A Member: I would like to follow through on this talk and state that in 1944 we carried out a similar program. We haven't actually tested any wire on any machinery in regard to martensite formation or what have you, but we have now had out in the field for four years some large static ropes — tramway strands—and we formerly had quite a bit of trouble on that, and I would like to say on large tramway strands, sizes, 195, 230 mil wire our results are entirely in accord with your talk.

Mr. Rylands: I am very pleased to hear that confirmation.

Mr. Dove: Would anyone like to expand further on the subject of reactive wire drawing? Ken, would you care to say anything about reactive wire drawing?

A Member: As I get older, I get more and more shy about speaking—expressing my ignorance, but I am a guy that never can refuse a challenge. I have been feuding with the entire mathematical brains of the British Empire for a good many years over, not only reactive wire drawing, but the whole system of theories and formulas regarding the stresses in the die, of which reactive wire drawing is simply an outgrowth. You know, in the old days when religion was a simple thing and a vital part of daily life, we used to have what they called "Experience Meetings," at which people imbued with a religious fervor got up and—as the saying was, "gave testimony"—got up and told where they stood with regard to certain principles. I don't hesitate to say I am still feuding with the British Empire and I will tell you just where we disagree. The stresses in the wire, which is in the cone of the die and undergoing reduction, I believe, by the British mathematicians—and I say British because they are the only ones who give any attention to the matter whatever—those stresses are believed to be of two kinds—radial compression stresses and tensile stresses, which somehow, in their calculations, work through the pull on the wire between the die and the block, and they never can agree among themselves what proportion each system of stress bears to the whole. That is why their formulas cover a half sheet of letter paper and involve these marks that betoken ignorance or—you know what I mean. In my view—which I have stated often and raucously, and will continue to state—there is only one system of stresses in that cone, and that is the radial compression stresses, which are induced by the pull on the—the exercise of the die. I cannot conceive how any of the tensile strength on the die can affect the cone that is undergoing reduction. That is why all the formulas and theories I have ever used are so simple. Hardly a month goes by that I don't get at least one letter from a professor in England, berating me for something I have published, and I always answer in the same tone and say to them, "You are having a wonderful time, but in ten years you will be coming right down to where I am"—and they will. Allan, that is all I have got to say. We are still feuding. There are some schools of thought regarding these matters. I am the sole representative of one; the entire British Empire, as far as its technical staff is concerned, is on the other side, and I stand alone, and I am going to continue. (Applause.)

Mr. Rylands: I am perfectly sure you do not stand alone, because years ago in my early days in the wire industry I worked out stresses in wire drawing dies in very much the same line as in your published work, and I do agree it makes it very nice and simple, and so far I have no reason to depart from a rather simple view of life.

A Member: You mean to say there are two of us?

Mr. Rylands: In all this business you have got to start with a hypothesis, and they either start from Von Missen, Sachs, or Pomp. Those are the three. They are all completely different, but by very ingenious mathematics the same result seems to be achieved. But the most striking paper (which I do think has a very great deal of sense in it) is

a paper by Hill and Tupper. It was a result of some investigations during the war, and was issued pretty generally throughout the British and American services. In fact, I believe a copy went to the Director of the American Nursing Corps, but a copy was not circulated to wire manufacturers! It seems to be odd, but we do those things that way. It is rather a very able paper, and if you do have an opportunity of reading it, you would be most interested in it. You have got to do it with a cold towel around your head and a whisky and soda, and you might get through it by the time the night is through.

A Member: How does one get the Hill and Tupper paper?

Mr. Rylands: I think I can send you a copy. I can get one. I'll lend you mine if you would like to take it, Mr. Lewis, and pass it on to your namesake, Mr. Lewis, and return it to me in due season.

A Member: Gentlemen, I noticed at one stage of the discussion Mr. Rylands appeared to be in some doubt with regard to the number of pounds in a ton, and it has occurred to me that he may be in equal ignorance of the value of the American cent.

What he said about reactive wire drawing conflicts with my own practical experience on the same machine which was subsequently used by the British Iron and Steel Research Association in their investigations. I had occasion to draw many tons of wire on that machine before it was handed over to the B.I.S.R.A., and one of the first things we discovered was that certain materials could be drawn on this machine at more than double the speeds

(*Please turn to page* 93)

Written Discussion of "Wire Drawing in the British Iron & Steel Research Association"

By G. B. Somerville,
Marshall Richards Machine Company
Durham, England

I NOTICED at one stage of the discussion Mr. Rylands appeared to be in some doubt with regard to the number of pounds in a ton, and it has occurred to me that he may be in equal ignorance of the value of the American cent.

★ ★ ★

WHAT he said about reactive wire drawing conflicts with my own practical experience on the same machine which was subsequently used by the British Iron and Steel Research Association in their investigations. I had occasion to draw many tons of wire on that machine before it was handed over to the B. I. S. R. A., and one of the first things we discovered was that certain materials could be drawn on this machine at more than double the speeds which had been possible, without loss of quality, when using orthodox machines.

★ ★ ★

I THINK it would be unfair for me to ask a lot of questions at this stage which might anticipate the promised publication of the conclusions, but there is one thing I would like to urge on any of you gentlemen who may be embarking on experiments of the same nature as those which have been carried out by the B. I. S. R. A., and that is not to lose sight of the indications that it may be possible to derive from the drawing of metals other than the metal in which you may be primarily interested. For example, I myself drew a large quantity of copper and brass, and some of the indications which were difficult to discover when drawing high carbon steel were very clearly discernible when copper and brass were being drawn. Just to quote two examples of this which may have no significance, or which may have a deep significance, we found when we were drawing copper that the diameter of the wire at the point where it first engaged with the die was actually less when a large amount of back pull was applied than it was with the same material drawn without back pull. From this observation we confidently anticipated that the kind of die wear which is known as "ringing" would be appreciably reduced by back pull drawing. Then, again, when we were drawing brass, it was discovered by examination of the cross section of the finished material that the grain structure was noticeably more uniform when drawn under heavy back tension than when the same material was drawn with a slack wire entering each die.

★ ★ ★

(*Please turn to page* 93)

ANACONDA
from mine to consumer
REG. U.S. PAT. OFF.

COPPER and COPPER ALLOY WIRE

in all Commercial Tempers and Sizes including Round, Flat, Hexagonal and Special Shapes.

Wire for Special Purposes
Copper, Brass, Bronze, Everdur and Nickel Silver in special grades for the manufacture of rivets, nails, pins, piano hardware, etc. Fine Wire on spools.

Resistance Wire
Nickel Silver.

Weaving Wire
Bronze (Antique Golden), Brass, Nickel Silver, Ambrac, Everdur*, Phosphor Bronze, Copper and Fourdrinier Wire.

Spring Wire
Brass, Phosphor Bronze, Everdur, Ambrac*.

*Trade Mark Reg. U.S. Pat. Off.

THE AMERICAN BRASS COMPANY

General Offices:
Waterbury 88, Conn.

District Offices in Principal Cities

Subsidiary of
Anaconda Copper Mining Company

47271

THURSDAY, OCTOBER 21, 1948 — 10:00 A.M.

Rodman R. Tatnall
Metallurgist
Wickwire Spencer Steel Div.
Colorado Fuel & Iron Corp.
Buffalo, N. Y.

Chairman of Meeting

PAPER: "Formation and Properties of Martensite on the Surface of Rope Wire"	by John H. Corson, Research Engineer	John A. Roebling's Sons Co. Trenton, New Jersey
PAPER: "Quality, Quantity & Service"	by N. T. Nelson, Jr. Rod & Wire Mills	Bethlehem Steel Company Sparrows Point, Md.

"Formation and Properties of Martensite on the Surface of Rope Wire"

by John H. Corson

Mr. Crewe: Good morning, gentlemen.

We have two very fine papers to be presented this morning by two of the younger members of the Association. It does me a great deal of good to see the interest the younger fellows are taking in our Wire Association.

The Chairman of the morning session is Mr. R. R. Tatnall of the Wickwire Spencer Steel Division of the Colorado Fuel and Iron Corporation. Mr. Tatnall.

Mr. Tatnall: Thank you, Mr. Crewe. My job right now is very short and simple, simply to introduce to you the first speaker, who is going to talk to us on the "Formation and Properties of Martensite on the surface of Wire Rope," a paper to be presented by John Corson, Research Engineer of John A. Roebling, Mr. Corson.

(At this point, Mr. Corson gave his talk on the "Formation and Properties of Martensite on the Surface of Wire Rope.")

Mr. Tatnall: It seems to me that Mr. Corson has certainly covered a lot of ground on this subject, and by that same token, he has undoubtedly inspired some thoughts in your minds. The meeting is now open for discussion. May I remind you to please give your name to the stenographer—identify your company—so that we will know to whom to send these proceedings. Are there any points for discussion now?

I had one question that as you presented your paper you mentioned—that the machine was set up with a twenty thousandths tool interference. Did that mean you actually deformed the wire that much in abrading it?

Mr. Corson: Yes. That is right. We measured the tool interference in this way: It took a lot of playing with it to try to get it exactly right, but we lowered the tool until it just touched the wire. It seems to escape me. That work was done some months ago, and so much has transpired in between. We found this to be happening: We got the twenty thousandths, and then we would measure the diameter of the wire, the thickness through the abraded section, and it wouldn't show that twenty thousandths. It had been knocked down twenty thousandths but there would be some elasticity there where it would spring back. I am sorry. I just forget it right now—how we measured the twenty thousandths, but we took that so we would have a broad section with which to work. We wanted to be generous with ourselves in our experimental work. Does that answer the question?

Mr. Tatnall: That was the point I was leading up to. If these samples are abraded, is that in line with what you find in rope in performance?

Mr. Corson: No. It is not. Most of the wires in which I have seen martensite have been smaller than—well, they haven't been in the ninety thousandths of an inch length. They have been more down in the sixty to seventy-five thousandths of an inch length. We have never actually measured how much has been taken off. Generally, these ropes begin to break up with a characteristic pattern and you know that they are breaking because of the martensite formation, and the thought of calculating how much has been worn off really doesn't make much difference. Ten thousandths may be worn off and then you get the martensite. You may get it right at the beginning.

Mr. Tatnall: Any other points, gentlemen?

A Member: I was wondering if the wires which you used came from lead patented or air patented stock and if it would make a difference, and then another question: Did you ever make any experiments on using higher manganese to try to reduce the hardness of the martensite?

Mr. Corson: In answer to your first question, we did not check to know specifically whether the wires came from lead patented or air patented stock. As I said in my paper, it doesn't make any difference what they came from so long as the heat is above the critical temperature, austenited form, and it will cool to martensite. The second point is if you get down to your lower carbon steel you are very likely to get some free ferrite and if you have free ferrite you are going to have a difference in your martensite as shown in the seventy-eight and fifty carbon steels which illustrated the martensite; and you wanted to know the effect of manganese. I don't think we are talking about rope wire now. Do you mean when you go above sixty-nine?

A Member: Over eighty.

Mr. Corson: In those proportions, any alloy will have no effect on the martensite. It is only when you get into very high steel.

A Member: I was thinking of the effect of using a lower carbon steel with a higher—I was thinking of the effect of using a lower carbon steel so not so much martensite would form.

Mr. Corson: That is all right, but on the other hand I believe that you air patent all your wires now?

A Member: Not necessarily.

Mr. Corson: A lot of them at any rate, and I think if you would go to lead patenting you could pick up that twenty or thirty pounds of tensile strength without expending more money for your manganese.

A Member: That paper is a good example of the danger of having these preconceived ideas in research and development. The wire rope people had problems of martensite for many, many years. The engineers have found out that by lowering the carbon content they could overcome martensitic difficulties in service, but the thing has always been mysterious. Sometimes you had martensite and sometimes not, and you had no control over the condition. In our company some of us made the mistake of having a preconceived idea that sometimes martensite was formed and sometimes it wasn't. All we had to do was to do something or other to prevent the martensite being formed. I think Mr. Voightlander has the same idea, because he said lowering the carbon content to prevent the formation of martensite. That idea put us off for years. It was only until this recent work that Mr. Corson has done that we came to the conclusion the martensite was always formed. We always got martensite, and it wasn't to prevent it from being formed, but how to get the ductility—how to get it ductile enough so it wouldn't crack. We wouldn't accept it, and that is why John Corson went through all that mathematical business and so on that he has described this morning—to try to sell himself and others that martensite was formed, even in the low carbon steels. You saw that nice photomicrograph. That showed it very clearly, and I think he has done a

(*Please turn to page* 95)

(At this point, Mr. Nelson gave his talk on "Quality, Quantity, and Service.")

Mr. Tatnall: I think most of us can remember back to the days when the cleaning house cleaned rods just as fast as they could push them in the mill. The boys in the mill then decided what they would make out of it. I also remember during some of the war years some rather sad experiences we had in the early days of the war with these WPB-48 forms and too many of us didn't have the service readily available that such a system as this would give. There is no question but what the system is needed, particularly in the wire mill, making such a diversity of products, to make an orderly progression of material through the mill. I think we should have some comments from the floor. Those of you who have read the paper can see that we have had presented here an excellent system and I am sure you must have some comments on it.

A Member: We have, all of us, worked out systems for putting through the mill. The mill man's biggest thought is to keep every man going so he doesn't run out of stock. We have each got some system of putting our wire and our orders through the mill and whenever we get a chance of looking at some other company's method of doing it I think it is a fine thing to look it over and give it study. Very few people study these articles in Wire and Wire Products, but they really pay. I didn't at first, but it really pays to put a little thought on them. It certainly is a far cry from the old method we used to have in passing the orders out to the wire mill and also a little piece of paper —a promise. Remember, the promise used to be "week or ten days." Every one that came in was "a week or ten days." Sometimes when a man had stock on hand he would say "two or three days." Each one of them was busy trying to figure out how to keep his mill going. It is a good thing to study some other man's method and see what he is doing. We think we have a wonderful one, but there is always room for improvement.

Mr. Tatnall: I think The Member forgot one element in the system he spoke of there where the orders were pushed into the mill. There always had to be a fellow that came around maybe three weeks—

A Member: (Interposing) I used to be that man.

Mr. Tatnall: I do strongly recommend that any of you who have any contact with the movement of material through your mills—as Mr. Voightlander said —not only read that paper, but study it and see how it fits your operation, because there is a lot in it and it is hard to discuss it, I agree, right now, but give it some attention. It is worth it.

Are there any other comments from the floor? I believe that concludes the program.

A Member: How have you reconciled your Sales Department when you promise, for example, four weeks or the fourth week of a certain month, and they say to get the business you have got to get it out in two weeks? Do they stick by your promise, or do you change your promise?

Mr. Nelson: In general, the only thing that would take us four weeks to make is something that comes out of the large size rods where there is a sequence set up on the large rod mill. Normally, twenty-eight days to a cycle, we roll every size from the smallest to the largest that the No. 2 mill is capable of in twenty-eight days and we definitely stick by that rod size sequence. The wires which come from those rod sizes must wait for the rods to be rolled before we can draw them, but for anything coming from the five gauge rods, which we roll every day in the week, there is no reason why we should have to wait four weeks. We are not quite so concerned with that problem. As I say, the majority of the tonnage which leaves our mill can go from billets to box cars in twenty-four hours.

A Member: Then your problem is slightly different from ours.

Mr. Nelson: Yes. It is distinctly different from the fine wire game. You have another problem entirely.

A Member: Say your product consists of seven or eight operations—how do you go about scheduling those operations from day to day?

Mr. Nelson: First of all, in this loading work we have considered the fact that a given product goes through seven or eight operations, and we are starting off the first day of each new period, presumably, with a right load—no underload or overload—on each of those operations—the orders which constitute the properly loaded mill appear on the various product schedules. That is, in producing wire we schedule only the finished material. The orders for galvanized wire, for instance, are scheduled on a product schedule which shows only the orders for shipment of galvanized wire. The provider, the person responsible for the production and shipment of galvanized wire, is also responsible to the other providers who may use galvanized wire to make other products, and there we have a system. It is a very informal system. We have provided stations around the mill in each of the finishing units, and these providers are responsible for supplying their products primarily, but also are responsible for getting the wire through their operation to another man along the line. For instance, we can make galvanized bale ties. The bale tie product provider would hand the galvanized provider a forty-hour wire requirement, saying in writing, "I need forty thousand pounds of galvanized wire for bale ties." The galvanized product provider knows that the bale ties have preference because they are the last people down the line. He puts that forty thousand on, plus enough other wire for his own products or for barbed wire to complete his operations for that day, and in turn this galvanized provider orders wire from the wire drawing provider to take care of all of those orders. You can't draw a diagram of a wire mill. It is just impossible, so we depend on these providers passing the forty-hour wire requirements around the mill from provider to provider. It is sort of like the Navy. You know you want to take the Pacific Ocean, so you put four men on each island. That is essentially what we have done.

A Member: We all know steel companies are up to capacity these days, and quite often, I believe, we are confronted with a situation—the steel companies are, rather—whereby they receive orders, and among these orders are not always carload lots, but smaller quantities. Under those conditions, of course, the mill, being up to capacity, usually likes to prefer those items that fit well into their schedule—that are convenient to run. However, what happens to those smaller quantities that are not always convenient in one's schedule? Are they pushed behind, or pushed along with those larger ones, somewhat upsetting the operations?

Mr. Nelson: We make a definite effort to have all the wire ready by the end of the month. Should we end up with five or six ten thousand pound orders ready and each of those orders has been indicated to ship in a carload, but there are no other carloads going out to that customer, then we advise the customer his wire is ready—put the shoe on his foot. If he wants to, he can give us a less than carload permission, or possibly accept the added expense of trucking, but we put the shoe on his foot. We have done the job. Most often, when we have shipped all of the carload to a particular customer and we end up with one smaller order for ten thousand pounds for that customer—there is nothing else to go with it in the current month, but next month there is an order for forty thousand. Then the customer says "Hold for shipment with that next order." It does cause a delay, but we try not to have the delay our responsibility.

Mr. Tatnall: Any further discussion, gentlemen? If not, that concludes our program for this morning.

(Whereupon, at 12:00 noon, Thursday, October 21, 1948, the meeting was adjourned.)

TO WIRE MILL MEN

Have you considered joining the Wire Association? You are cordially invited to become a member. Dues are $15.00 a year, which includes a subscription to WIRE & WIRE PRODUCTS and a copy of the Annual Buyers Guide.

THE WIRE ASSOCIATION

300 MAIN STREET **STAMFORD, CONN.**

FRIDAY, OCTOBER 22, 1948 — 10:00 A.M.

Bruce W. Gonser, Research Supervisor
Non-Ferrous Metallurgy
Battelle Memorial Institute
Columbus, Ohio

Chairman of Meeting

PAPER: "The Processing of Brass Wire"	by Christian Witteveld	Bridgeport Brass Company Bridgeport, Conn.
PAPER: "Hot Dip Aluminum — Temperatures and Methods of Application"	by Clarence Ulshafer Metallurgist	Hughesville Machine & Tool Co. Hughesville, Pa.

"Hot Dip Aluminum — Temperatures and Methods of Application"

by Clarence Ulshafer
Metallurgist

Mr. Crewe: I think we better open the meeting, gentlemen. If we tend to let the hour slide back a little each session, before we finish we will be losing a lot of valuable time.

Up to this point, the papers have been dealing mainly with ferrous subjects. Starting with today we have a series of non-ferrous papers, with one exception. I know there has been a great deal of sentiment and feeling among the members of the Association that we should have more non-ferrous papers. I have been quite gratified at the response we have had from the non-ferrous people this year, and I know that Fred Crapo feels that we should have even more papers on non-ferrous subjects next year.

Your Chairman for the morning session has just returned from England. It is very gratifying to me that he could come to this meeting. He has made quite an effort to be here. He is Mr. Bruce W. Gonser, Research Engineer for non-ferrous metallurgy at Battelle Memorial Institute. Mr. Gonser.

Mr. Gonser: Thank you, Mr. Crewe. Gentlemen, I am glad to be here this morning, not just because I got back in time for this session, but after spending a hectic half-hour outside of Steubenville, I didn't know whether I would get here or not. Anyway, this session is interesting in that it does deal with non-ferrous subjects. It is nearly the tail end of the whole Convention and I would say it is the dessert of the crop. I think you are in store for rather interesting papers, the first one particularly, being on hot dip aluminum, has not yet been printed, and you will have to pay close attention to get the full benefit of what is given.

The first paper is "Hot Dip Aluminum —Temperatures and Methods of Application," by Mr. Clarence Ulshafer, Metallurgist, Hughesville Machine and Tool Company, Hughesville, Pennsylvania. Mr. Ulshafer.

(At this point, Mr. Ulshafer gave his talk on "Hot Dip Aluminum—Temperatures and Methods of Application.")

Mr. Gonser: This material on hot dip aluminum is sufficiently new that we are somewhat handicapped, those who know the process being unable to give information, but I am sure Mr. Ulshafer would be glad to discuss with you any topic that may be brought up and answer questions. The paper will not be published until the December issue of Wire and Wire Products so now is the chance to get the information. First, are there any written discussions? If not, those of you who have questions or topics relating to the subject come forward and give your name so it can be recorded properly. Just to be sure we are not being unduly restrictive on the subject, let me say you will have a chance to make additions later if you wish. Any discussion?

A Member: I should like to ask Mr. Ulshafer whether he would venture a guess as to why the process hasn't been more widely used.

Mr. Ulshafer: I can't answer that too well. I think perhaps there are gentlemen within the audience who have had considerable more experience and have been working with this information quite a bit longer than I have. The only explanation I could offer is that the material has been tied up; that is, the work that has been done has been tied up quite largely by patents that have conflicted with each other.

A Member: Some years ago I recall that the Reynolds Metal Company—I think it was—had a pilot plant in Knoxville, Tennessee and were experimenting with the impregnation of strip and wire with hydrogen and coating with aluminum. There was a plant running about 1938. Can you tell us anything about that—how far they went, whether they developed anything practical?

Mr. Ulshafer: I can't tell you too much about that with this exception; that pilot plant was operated under the process that was developed by Doctor Fink of Columbia University and out of the work that was done at that plant, later two gentlemen by the name of Sheshunoff and Whitfield developed a process for bonding aluminum castings to steel which was used by the Fairchild Aircraft Corporation during the war. They used the process to cast aluminum fins to steel aircraft cylinders, but as far as its use for wire, I don't know of any great stride that was made as a result of it.

A Member: There has never been any question in my mind that for the long pull aluminum was going to drive steel out of the mill. It is cheap and will probably get cheaper, and on the basis of covering power it is ahead of tin right now. Would you care to make any comments on the process that has been —I won't say exploited—but suggested by that Company?

At the meeting of the Wire Association in Worcester Dr. De Guilio gave a paper on the subject. I don't think enough has been made of one terrific advantage of aluminum over any other coating metal for steel, and that is what you might call its terrific electro-negativity toward iron. It not only beats zinc, but it beats the metals that beat zinc. Of all the metals in our reach as coating metals, aluminum stands at the head. It seems to be a natural.

After hearing Doctor De Guilio this spring, I expected a whole rash of experimental developments to crop out. Are you familiar with that process?

Mr. Ulshafer: Only to the extent of reading Dr. De Guilio's article, but I think there have been quite a number of experimental installations. Most of the data that have been accumulated as a result of those experimental installations, so far haven't been released.

A Member: My recollection is he dispensed altogether with metal pot. He used a brick furnace and there was a salt used in this brick chamber, by means of electrodes flush with the side walls, and that the aluminum was thrown into the salt bath, was melted by the salt, and floated on top of it, and that the salt was of such a nature that it crept up along the brickwork above so that along the sides of the bath it passed the aluminum puddle, protecting the brick work against any possible corrosive action by the aluminum and then crept over the top of the aluminum bath to form a blanket, so you had a puddle of aluminum completely surrounded by this heavy salt, so that the wire could enter the aluminum and leave it and introduce no oxygen and leave no oxygen.

The other details of the process were described as being exactly the same as for galvanizing. The wire was pickled and plunged into the bath, came out, was wiped, and taken up on blocks. The samples he showed were extremely interesting, but we understood that at the time he used a little child's-size bath from which he could dip the stuff by hand. Do you know anything more about that?

Mr. Ulshafer: No. I don't know anything further about that.

A Member: Do you know whether there are any obvious disadvantages that are preventing ambitious people from looking into that? I told Doctor De Guilio after the lecture, "This is too good to be true. What's the gimmick?" He said, "There is no gimmick. Ask any questions you want." What was that salt? I can't remember. Do you know?

Mr. Ulshafer: No. I don't know.

A Member: Some salt that the alumi-

(*Please turn to page 95*)

(At this point, Mr. Witteveld gave his talk on "The Processing of Brass Wire.")

Mr. Gonser: Mr. Witteveld had to cover a wide range of generalities, but I am sure he would be willing to take up certain items in more detail. The meeting is open for discussion. Anyone who would like to bring up a topic or question, do so. Since we got along so well with the other paper, speaking from the audience, I don't think you will have to come up to the platform.

A Member: I was interested earlier in Mr. Witteveld's statement on replacing rolling by extrusion. I don't know anything about brass, but in the aluminum field, depending upon the alloy, there is a similar problem. Assuming that you are just taking the sheeting rod, for instance—never mind the architectural shapes you can't roll—is there any particular reason why extrusion is replacing rolling?

Mr. Witteveld: Most mixtures can be either hot or cold rolled, but the majority of mixtures that must be cold rolled require numerous rolling operations with annealing in between passes, particularly in the volume leaded brasses, since these mixtures cannot be reduced more than thirty to thirty-five per cent between roll passes. By extrusion the metal can be extruded directly to the size required for finish making it a more economical process as compared to rolling.

A Member: What about hot rolling versus extrusion?

Mr. Witteveld: The reasons for the reduction in mixtures hot rolled are primarily to obtain a better quality stock for manufacturing processes and to reduce mixture cost by being able to use a higher percentage of scrap.

A Member: How about using extrusion to obtain the billets or bars for the rolling mill instead of cast bars.

Mr. Witteveld: Some strip metal for sheet rolling has been extruded, depending upon the alloy. Consideration must be given to the width that can be extruded so as not to seriously effect rolling costs plus the cost of extrusion versus hot rolling a cast bar.

A Member: It is the economics of rolling cast bars versus extrusion of bars for sheet rolling in your case?

Mr. Witteveld: That is right.

A Member: Thank you.

A Member: Would you care to make any comments about bright annealing?

Mr. Witteveld: My understanding is that you cannot bright anneal brass unless you can get down to a low enough temperature so that a zinc coating does not form on the metal. The annealing temperatures for specifications we must meet are above this minimum temperature and were a reducing atmosphere used it would still be necessary to pickle the material for shipping or reprocessing. For this reason we do not attempt any bright annealing.

A Member: You do not use any reducing atmospheres at all?

Mr. Witteveld: None at all.

A Member: It seems to me comparing the hot rolling process with the method of extrusion, one of the advantages you get by extrusion is improvement in your surface quality. Isn't that the major reason for the trend toward the extrusion method, rather than hot rolling?

Mr. Witteveld: It is. It has been necessary to go into the extrusion of metals that were previously hot rolled in order to get a better surface quality on the metal for fabricators, who demand metal free from surface defects so that no cracking will result during heavy cold forming operations.

A Member: The gentleman made a statement that you don't use a reducing atmosphere in your annealing. What type do you use?

Mr. Witteveld: The process anneals are done in the roller hearth direct fire continuous feed type furnace which provides sufficient control for the annealing of material for the process rundowns. Finish anneals are done in the batch type convection furnace which provides the close control of grain size specifications for finish work.

A Member: Do you have any trouble getting rid of your oxide during the pickling operation?

Mr. Witteveld: From the batch type furnace we obtain a fairly clean wire and do not experience any trouble in removing oxides. From the direct fired roller hearth furnaces, the metal does get a heavier coating of oxide and the cleaning time necessary is increased, particularly in the high copper alloys.

A Member: You mentioned grain structure during extrusion. Is the grain structure of the higher copper alloys effected more than that of the lower copper alloys?

Mr. Witteveld: From my knowledge the grain structure of the lower copper alloys are the more effected by extrusion. During the extrusion cycle, the initial metal coming out will be the hottest but as the cycle nears the end and the billet has cooled and extrusion pressure has increased—you will find that you are apt to get an entirely different grain structure at the last end of the extrusion than you have at the beginning. Uniformity throughout the metal can be obtained by annealing the extruded material or giving the extruded metal a heavy reduction so that recrystallization in the anneal to follow will be uniform.

Mr. Gonser: I might ask a question: Do you find that continuous cast ingots are of any benefit to you—any disadvantages? I don't know whether you have ever tried them or not.

Mr. Witteveld: Yes. We have a continuous casting procedure, and the billet surface is good.

Mr. Gonser: It sounds reasonable.

Mr. Gonser: Any other discussion or further comment? It happens that this year at the A.I.M.E. meeting there will be two papers presented from Battelle concerning the alloying and making of wire from a copper-silver alloy, which gives it high strength and ductility. Another paper will be presented covering copper-iron wire containing about twelve per cent iron, which also gives an unusual combination of conductivity and strength. I was wondering if either of these combinations could be extruded. We have not extruded them because we do not have the equipment.

Mr. Witteveld: You mean the silver-bearing coppers?

Mr. Gonser: Yes. Six and a half per cent silver copper—would that be an extrudable material?

Mr. Witteveld: Yes. We were recently discussing an inquiry for a silver bearing copper for engraver's use and although we have not as yet extruded any, we know we can. We have cast silver-bearing copper in bars for the sheet mill, and I don't believe we will therefore experience any difficulty in both casting or extruding this type alloy.

Mr. Gonser: How about the copper-iron?

Mr. Witteveld: We have had no experience in making copper-iron alloys.

Mr. Gonser: Do you think it could be extruded?

Mr. Witteveld: I would not say offhand. Copper-silicon alloys, which are in the same field, are extruded but do not contain the high percentage as in the alloys you are considering. I would say that if at all possible it would be a very difficult alloy to extrude.

Mr. Gonser: Any other discussion?

A Member: You have to be very careful in making the distinction between silver-bearing copper and the copper-silver alloy. Silver-bearing copper has only a very small percentage—thirty ounces of silver is the highest. What Mr. Gonser was talking about, a silver-copper alloy, can be extruded but I have my doubts about the copper-iron. It seems there would be no difficulty in extruding the copper-silver alloy of which you spoke. The silver has a definite tendency to raise the annealing temperature. For example, I think we can agree that on very high duty commutator segments silver-bearing copper is regularly required, and it has many other uses where that quality is desired.

Mr. Gonser: Any other discussion? Is your curiosity satisfied so quickly? If there is no further discussion, I certainly want to thank Mr. Witteveld for having given us a good paper that raised considerable discussion. Mr. Crewe, do you have anything?

Mr. Crewe: No, I do not have anything to add. I think when we have finished with this paper the morning session can be adjourned and we will start up again at two o'clock this afternoon.

Mr. Gonser: We will formally declare this meeting adjourned.

(Whereupon, at 12 o'clock noon, Friday, October 22, 1948, the meeting was adjourned.)

FRIDAY, OCTOBER 22, 1948 — 2:00 P.M.

Frank Leahy
Vice President
Nichols Wire & Aluminum Co.
Davenport, Iowa.

Chairman of Meeting

PAPER: "New Materials for Wire and Cable Applications"	by H. L. Wuerth, Geon Division	B. F. Goodrich Chemical Co., Cleveland, Ohio
PAPER: "Fatigue Testing of Wire"	by F. A. Votta, Jr.,	Hunter Spring Company Lansdale, Pa.
PAPER: "A Method For Measuring Lubricant Effectiveness in Non-Ferrous Wire Drawings"	by C. B. Shopmyer, Apparatus Dept.	General Electric Co. Schenectady, N. Y.

"New Materials for Wire and Cable Applications" — by H. L. Wuerth

Mr. Crewe: It is very heartening to see so many of you gentlemen here to attend the last of our 1948 Wire Association Convention.

We have this afternoon three very excellent papers. Mr. Frank Leahy, Vice-President of Nichols Wire & Aluminum Co., is your Chairman for the afternoon session. Mr. Leahy.

Mr. Leahy: Gentlemen, our first paper is titled "New Materials for Wire and Cable Applications." It will be presented by Mr. H. L. Wuerth of the Geon Division, B. F. Goodrich Chemical Company of Cleveland. Mr. Wuerth.

Mr. Wuerth: Thank you, Mr. Crewe and Mr. Leahy.

(At this point, Mr. Wuerth gave his talk on "New Materials for Wire and Cable Applications.")

Mr. Leahy: Gentlemen, as is usual after the presentation of a paper, Mr. Wuerth has consented to answer any questions that any members may have. The Chair is open for questions that will be answered by Mr. Wuerth.

A Member: I would like to ask Mr. Wuerth if they have had any test result on the action of salt water or salt spray on these TW compounds?

Mr. Wuerth: We have not conducted any actual experiments along those lines. I think it has been the general feeling that through the various applications made by various wire producers and discussions of material being left in salt water, that the material stood up all right, but as far as giving any resultant tensile elongations after so many months, or change in insulation resistance, which is what you are probably interested in, I couldn't right now give you any black and white data; but I will be glad to try. If you are interested in that, I can probably check with our laboratory.

A Member: I wondered if you could tell us anything about what the utilities in the United States are doing about using T&TW underground?

Mr. Wuerth: In direct contact with the earth?

A Member: Yes.

Mr. Wuerth: As I understand it, there are quite a few utilities that are now employing control cables in sub station work and applications of that sort — employing cables with a PVC primary insulation and a PVC jacket, for direct burial.

A Member: Do you know of anyone using straight TW wire without any sheet for service entrances underground?

Mr. Wuerth: No, I don't. There, again, I believe it is within the suitable range of properties of PVC. That is probably due to several factors, one of them being underwriters' requirements for standard service entrance cables. We have experimental service cables—one hundred per cent PVC wire—which our own company has developed and tried for our own information, which stand up very well. It has been my impression, for one thing, in the industry that just the cost factor versus the present standard construction has not been a great impetus to manufacturing this PVC service entrance cable.

A Member: What is the relative cost of this type of insulation?

Mr. Wuerth: You are referring to the Hycar PA?

A Member: That's right.

Mr. Wuerth: At the present time, it is about a dollar and ten cents a pound. The material is still a pilot plant product as far as we are concerned, and while I can't make any predictions about the ultimate low cost, I think it has been a very standard procedure in the whole chemical industry that as these things are brought into large scale production the prices come down perceptibly. I think neoprene and polyvinyl chloride are very good examples of that.

A Member: I was wondering what the approximate resistance of these compounds are. Are you not still using nylon coats for abrasion?

Mr. Wuerth: Well, when you get into a discussion of abrasion resistance, you get into so many angles of how you are going to test abrasion resistance that it is rather difficult to answer. I think nylon is being employed now on various types because it is relatively tougher, perhaps, in some applications. I think assault wire—infantry wire — during the war nylon was much better than the primary Poly-F insulation first employed, and there are some types of polyvinyl chloride jacketed with nylon. However, in other cases — some Navy shipboard cases for example, the very slick surface of a good type polyvinyl jacket in gun director turrets where they have to move up and down through little metal guides—in that case a vinyl jacket is superior to neoprene, which tends to have a sort of rubbery cling. It is probably of more interest to some of you people in the steel wire industry. I have noticed nylon has been used as a jacket on some steel aircraft control cables and things of that sort where in a straight test apparently nylon stands up better than vinyl.

Mr. Leahy: Does anyone else have any questions? If not, we will proceed with the reading of the next paper.

The second paper is entitled "A Method for Measuring Lubricant Effectiveness in Non-Ferrous Wire Drawing." This paper has been prepared and will be read by Mr. C. B. Shopmyer of the Apparatus Department of the General Electric Company, Schenectady, New York. Mr. Shopmyer.

(At this point, Mr. Shopmyer gave his talk on "A Method for Measuring Lubricant Effectiveness in Non-Ferrous Wire Drawings.")

"A Method For Measuring Lubricant Effectiveness in Non-Ferrous Wire Drawings" — by C. B. Shopmyer

Mr. Leahy: Thank you very much, Mr. Shopmyer. I am sure with all the lubricant and die men I see here we should have no difficulty getting a lot of questions asked of Mr. Shopmyer. Will somebody start it, please?

A Member: I congratulate Mr. Shopmyer. He is one man connected with the wire industry who, fortunately, found time to do some investigating on lubricants, and I wish him plenty of success in his study.

Some years ago, we did quite a moderate amount of work on this type of thing and found out some interesting things, and I believe in the course of time Mr. Shopmyer, when he gets rigged up with this newly developed machine, will really make a splendid contribution. He is really getting a good start.

Mr. Leahy: I am sure we all concur with Mr. Williams in his beliefs about the work Mr. Shopmyer has done. I still see a lot of lubricant men around here, some of them from Chicago. Chuck, you must have some questions. How about Floyd over there?

A Member: I think it is a step in the the right direction and I am interested in seeing how much further we can go on that line, but I think that study should be made with lubricants and dies in absolute connection, like you have already proceeded, because in a lot of cases I think it is the shape of the die that determines how well the lubricant is going to work and vice versa, the lubricant determines how much production you get out of the die, and I want to congratulate Mr. Shopmyer on his paper and I think we are starting on the right road.

Mr. Leahy: How about a die man?

A Member: I am not a die man. Mr. Shopmyer suggested a comparison — twenty-five degree approach angle and bearing length. What do you find if you use a long bearing—do you get good results or do you still get a reduction in diameter?

Mr. Shopmyer: To date we have been primarily interested in obtaining figures on wire drawing lubricants. We have been using dies with approach angles in the vicinity of 16 degrees. With die angles in the vicinity of 25 degrees I would expect to get different results.

A Member: Due to bearing length or not?

Mr. Shopmyer: The two work together.

A Member: You should still keep your bearing down, regardless of your approach angle?

Mr. Shopmyer: I think you should keep it down regardless, yes.

A Member: I hesitate to interject anything at this point which would further confuse an issue that may be somewhat clarified by this sort of study. I am very much interested in what has been said about all these items being tested under, or approaching, mill conditions, because I have been an observer on tests in various mills over the past six or seven years, attempting to prove one thing or another about various carbide grades in particular, and also on some diamond dies, and the results are never worth while in my estimation, because you have never been able to control or accurately watch it along with the varying graded carbides. I am glad to see Mr. Shopmyer is a young man, because he has got a long time ahead of him.

A Member: I was wondering if anything had been done on die temperatures, friction generated in a die—or is that the sixty-four dollar question?

Mr. Shopmyer: To accurately measure temperature in a die would be pretty difficult. The next best thing is to more closely control the temperature of the lubricant, which we do. We find that the ideal range is between one hundred and twenty and one hundred and twenty-five degrees F. for most lubricants.

A Member: If you can keep it cool so that your wire will come out cooler, so your power in your machine is released, that should be a good result.

Mr. Shopmyer: That is right. A good die shape will help that.

A Member: Did I understand you to say that with a larger angle for the same amount of reduction you got a greater draw pull?

Mr. Shopmyer: Yes.

A Member: It is my impression that in our mill when we take a heavy reduction we open up the die angle and make a short bearing, and that seems to eliminate heating. You said the draw pull requirements were greater when your opening angle was large?

Mr. Shopmyer: That is correct, but you are still speaking of the same reduction. We never go beyond that on a diamond die. I might add when the new equipment—which I hope to have in the near future—is delivered, we will include tungsten carbide dies.

A Member: We draw sizes way above the sizes you are talking about. I thought maybe you had gone into the larger sizes. I was thinking of a quarter inch and up.

A Member: I was talking about single gauge reduction.

Mr. Leahy: Any more questions? Thank you very much, Mr. Shopmyer. (Applause.)

"Fatigue Testing of Wire" by F. A. Votta, Jr.

Our third and final paper is titled "Fatigue Testing of Wire" and it will be delivered by Mr. Frank Votta, Jr., of the Hunter Spring Company, of Lansdale, Pennsylvania. Mr. Votta.

(At this point, Mr. Votta gave his talk on "Fatigue Testing of Wire.")

Mr. Leahy: Thank you, sir for a very interesting paper. Mr. Votta is prepared to answer any questions, gentlemen, so let's go. Does anybody have any questions, please?

A Member: Mr. Votta, I think your paper is to be highly commended. I am terrifically interested in the material which you presented today because I think it has so many different angles to it. It has the possibility of starting up a number of different investigations.

You didn't mention in your paper any of the work which you may have done on the effect of stainless. I am under the impression that most of the stainless of the spring wire which is made has another metallic coating on it. These spring wires which you buy and subsequently make into springs (from what I have seen of them) when you get the spring it also has the residual coating on it. Have you ever evaluated the effect of those residual coatings? Have you ever evaluated the effect of passivating stainless steel?

Mr. Votta: The answer to both those questions is quite simple—no. We have run fatigue tests on stainless steel wire, but always as received—with the coating on it. Through the last ten years we have run some four hundred fatigue tests. During the war, our research work was halted completely and we are just getting back into it. There is a lot of work to be done. That is one of the reasons I wanted to present the paper, so we could get other people interested. I am sorry I can't answer your inquiry any better.

A Member: I was very much interested to hear your statement that there was no constant relationship between the tensile strength of the wire and fatigue value. Will you elaborate on that somewhat, because in many other investigations, that has not been found. Either of the two is wrong.

Mr. Votta: Well, there is one thing to keep in mind. Up to this time, there have been no investigations into the fatigue properties of small diameter wire.

A Member: Are you familiar with the work Doctor Kenyon has done?

Mr. Votta: Yes, indeed. I am familiar with a lot of his work, and he has not gone down into the finer wire range to my knowledge.

A Member: How fine does your work take you?

Mr. Votta: Our work has gone down as far as five thousands of an inch in diameter wire, up to about .030 inch diameter wire. That is the range of this particular machine. The only limitation is that of space required. If we wanted to go up to a wire a tenth of an inch in diameter, we'd need a distance of about four feet to give us a high enough stress in order to fracture the wire in a short time, but we have found that in these small fine wires—spring wires—there is no close correlation between tensile strength and fatigue limit. There is a broad correlation when we consider a wide band of tensile strengths.

A Member: May I ask whether you have done any work on low tensile material?

Mr. Votta: No, we haven't. All our work has been on spring wire.

A Member: Do you think you might have possibilities in the non-ferrous field?

Mr. Votta: I am sure it has. I think I might mention that we have run tests on a number of specimens of phosphor bronze, beryllium copper and spring brass wire.

Mr. Leahy: Are there any further questions? I guess that is all, Mr. Votta. Thank you. (Applause.)

Gentlemen, in behalf of the three speakers, I want to thank you for your courtesy and attention. Unless Mr. Crewe has got something more to say, we will bring the meeting to a close.

Mr. Crewe: That is it, gentlemen.

(Whereupon, at 5 o'clock p. m., Friday, October 22, 1948, the meeting was concluded.)

Have you placed your

ADVERTISING ORDER

for the 1949 Edition of the

WIRE and WIRE PRODUCTS BUYERS GUIDE?

Hundreds of changes in product listings, new sources of supply and corrections in old listings will make the 1949 Edition a necessary buying reference for those who are purchasing rods, wire, machinery equipment and supplies pertaining to our industry.

The fact that the BUYERS GUIDE is the Bible of the wire industry, makes it a good place to reinforce and emphasize your regular listings with display advertising. It helps you to sell, by helping the buyer to identify quickly, exactly what he wants, WHEN he wants it. Operating men, engineers and management executives look to the BUYERS GUIDE for information on sources of supply.

Present the merits and advantages of your products in the 1949 BUYERS GUIDE. Advertising forms close February 15th, so please act promptly.

If you do not have the advertising rates,
please write today to

WIRE AND WIRE PRODUCTS

EDMUND D. SICKELS, Adv. Mgr.

300 MAIN STREET STAMFORD, CONN.

The Wire Drawing Die

By Kenneth B. Lewis
Consulting Wire Mill Engineer
Worcester, Mass.

When, where and how did the wire drawing die develop? A short review of improvements in the Art of wire drawing resulting from the development of the die to its present perfection.

MOST of the various adjuncts and circumstances relating to the drawing of wire are subject to infinite variation or complete suppression. The rod may be (but seldom is) round, or square, or any shape, any size, any length. It may be freed of scale by any of a number of processes, or left uncleaned. Its surface may be variously prepared, and coated with any or all of a number of substances, or none at all. Lubrication may be applied as oil, fat, soap, decaying and fermenting vegetation, yeast, warm water, plastic films, or nothing whatever. Power may be of the human muscles, a team of oxen, falling water, a screw, or what have you. There is, however, one and only one fixed and essential accessory, **the die.**

★ ★ ★

IT is surprising how accurately the die has kept its basic character down through the ages. In our earliest knowledge of its nature it was, as we now know, an aggregate of metallic carbides massed in a matrix of softer material. How better could we describe it today? In a thousand years we have learned, what? Only to know what we have, and how to trim away the non-essentials.

★ ★ ★

A THOUSAND years ago the die was first described as a piece of iron two or three fingers wide, rather thinner, pierced with two or more rows of holes. Two hundred years ago was published a careful review of the process of making wiredrawing dies. They were still of iron, two or three fingers wide, rather thin, and pierced with several rows of holes, and there is no evidence that except for the gem stones that have always been used in a restricted range, any other material was ever seriously tried.

★ ★ ★

KENNETH B. LEWIS

Consulting Wire Mill Engineer, Worcester, Mass. The Wire Association Mordica Memorial Lecturer for 1941. Born Bridgewater, Mass., and educated public schools, Quincy, Mass., A.B. Harvard University. From 1904 to 1907 with Bethlehem Steel Company, becoming Asst. Supt. of open-hearth furnace. From 1907-1909 with the American Steel & Wire Company, Worcester, experimental work on wire. From 1909-1932, Morgan Construction Company, building wire mill equipment. In 1932 established own practice as Consulting Engineer in which occupation he is now engaged.

NO doubt many have wondered, as I used to, why it is so nearly impossible to learn anything about wiredrawing practice from the old records. Pioneers and merchant princes have left us their autobiographies, diaries, account books, personal and business correspondence, and the like. I have fought my way through battalions of book-worms in the search for clues, and found nothing. "Could it be," I have asked myself, "that the merchant princes didn't know how their wire was being drawn?" Could be; in fact it was.

★ ★ ★

HERE is the set-up. The wiredrawer has a couple of dies, and a few tools; they belong to him, they and the secrets imparted to him by his father or his master constitute his stock in trade. The owner finances the business, sells, buys raw material, provides a work-place with power, keeps the books. He gives the wiredrawer rods, or process wire; he gets back finished wire. The intermediate steps are none of his business, and if he thinks different he is due for a rude shock. Much of this spirit carried over into this century. When **Cy Johns** first went into the mills he was assigned the job of securing from the wiredrawers their complete drafting practice, so that it might be codified and standardized. Cy narrowly escaped lynching.

★ ★ ★

I THINK it can be said that those who could read and write didn't know how wire was drawn; why should they? Reading and writing were not ordinary accomplishments, and their practitioners could cash in on them to better advantage. Those who could draw wire either couldn't or wouldn't

write. Why should they? Give away the trade? No. **Oliver Evans,** the only literate person who ever had contact with wire in a practical way in the early days, said, in 1812, "The workman must discover the quality of the iron and by experience learn the smallest size at which it will bear its last annealing to make good elastic wire." Notice that he said "the workman." He, himself, by that time one of the foremost engineers of the country, had drawn card wire as a boy, during the American Revolution, when imports of that commodity were cut off.

★ ★ ★

THE earliest useful description of die manufacture I know of was written for the French Encyclopedia, probably about 1760. It describes how a bar of wrought iron is heated and scarified on one side, so that it has deep furrows. These are to hold the so-called "potin," which is thus prepared: Cast iron pots are cracked up into small bits and mixed with charcoal, and the mixture heated till it is pasty and half melted, then quenched in water. Again the product is cracked up, mixed with charcoal, fused, and quenched. This goes on for ten or a dozen cycles. Then this potin, powdered up, is packed into the furrows on the face of the iron plate, the whole thing wrapped in a coarse cloth dipped in slurry, heated in the forge, and gently hammered. This heating and hammering goes on repeatedly until there is a good amalgamation between the two ferrous materials, after which the bar gets a long slow cooling in powdered fireclay.

★ ★ ★

THIS is a pretty straightforward story. The pot metal, originally cast iron, loses its silicon and goes to white iron; its carbon, due to repeated chilling and loss of silicon, becomes all cementite, carbon drops, and by the time the stuff is ready to weld to the iron plate it is in that ill-defined zone between white cast iron and hypereutectoid steel. It fuses in the forge fire while the wrought iron is still firm; they gradually permeate each other, and the finished bar is what was known a century ago as a German plate. These tools were still to be found in the mills when I came into the industry. Old-timers had them, and would trot them out for difficult jobs. Many of them were quite large. All were thickly peppered with holes, and unlike all other dies, the holes were of all conceivable sizes. Equipped with one of these plates a man was almost set up in business. The holes had been punched nearly through the plate when hot, from the soft side, and finished cold by the owner, who kept them set up, always back to the same size, by hammering on the steel side.

★ ★ ★

WITHOUT chapter and verse to back me up, I believe that die making went along different lines in England. The big forged plate with the handle, known to our childhood days as the "wortle" (from the town of Wortley), was much more common than the compound plate just described, though it is certain that both were known in England, and both on the Continent. The compound plate was always referred to as German, and the big paddle-shaped die was always known as the wortle, or the English die. The town records of Coventry in 1435 listed three lads named **Smyth,** respectively, Joh, Tho, and Will, all "wirtil makers."

★ ★ ★

James R. Longwell, Assistant to President, Carboloy Co., Inc., Detroit, Mich. * * *

THE cast iron die will be fresh in all minds. When I came into the mills it was distinctly top-dog, though steel plates were hanging on valiantly among the conservatives. Such Europeans as I had contact with were always amazed at our use of these dies, and for years I believed they were an American invention, but on my first trip through Sweden in 1928 I found them in such extended use that each mill of any size was casting its own dies. I found later that they were brought to Worcester by the earliest of the Swedish invaders. They spread fast after one of the Swedish die makers had taken the secret to **McFarland Foundry & Machine Co.** and later to **Syracuse Wire Die Co.** Many will remember the **American Wire Die Co.** of Worcester, started thirty years back by **Earl Vickery** and the two **Larssen Brothers.** At the time the carbides swept over the wire world they were top dogs in the die trade. Perhaps some will remember **Earl Israel,** and wonder whether he was related to **Earl Vickery.** Yes; here's how it was. The Israels were an old Scotch family that came here from Nova Scotia; I knew them well. Earl found himself in a business that was almost monopolized by the Chosen people, and with the name Israel he was being steered into so many Kosher and Passover affairs that he had either to change his name or be circumcised. He took his mother's maiden name.

★ ★ ★

ALL through the history of wire, efforts have been made by clever and well-meaning people to wake the poor hide-bound wire makers out of their lethargy by introducing new die materials, based on the thesis that the one priceless quality is hardness. They looked on with pitying smiles as we banged away at our steel plates, work-hardening the matrix, when we might much more easily get hardness by quenching. Except for the gem stones, which have had a small field since the dawn of the art, all these substitutes have failed, quickly and completely. Chemistry never gave us the clue,

we had to wait for the microscope to identify the successful die as an aggregate of metallic carbides supported in a softer and malleable matrix.

★ ★ ★

THE carbides of tungsten, tantalum, and other of the rarer metals are the hardest man-made substances known, distinctly harder than the ferrous carbides of the old days. These harder carbides could be artificially massed in great density in a matrix of cobalt to give a super-die. Now we are about to plunge into the history of the carbide die, the real object of this paper. This is contemporary stuff; it happened before our own eyes, and happened so fast we are still gasping. There has not been time for the boiling down and clarifying processes that take place over the decades, dimming the non-essentials, high-lighting the significant details, and giving us at last a smooth chronological record. All I have is a lot of material; I shall flounder around badly, no doubt, but I shall make a start. After all, the impressions of a contemporary are always interesting to the historian; I am writing this not for you who read it in 1948, but for the research student of 2000. Let me remind you that now is the time to correct my errors.

★ ★ ★

THE carbide die was a potent factor in the recent revolution in wire, the third such upheaval in its history. The first was about 1360, when **Rudolph of Nuremberg** introduced the water-wheel, whose cam-studded shaft pushed down the bell-cranks and caused the tongs to grip and pull a couple of feet of wire and then slide down the sloping bed on the back stroke and take another grip. That was before my time, but it is all down in the town records in decent Latin, and there is no denying the fact that it was quite an advance over the strictly man-power production of the day. When Rudolph's young son got plastered and let out the secret to a competitor, the old man was so perturbed that he chased the boy through the streets of Nuremberg with a carving knife.

★ ★ ★

ONE hundred years ago Rudolph could have stepped into any wire mill and felt at home. But the second revolution was brewing. As we look back now and get the long view, we see that it was sparked by the electric telegraph, which for the first time created a demand for coarse wire with a good surface and in long pieces. Rods had been creeping up in length, they had been drawn in a tentative way on rotating blocks, but this new demand broke the dykes and let loose a flood of latent improvements. **George Bedson's** continuous rod mill was a potent factor, perhaps the most potent, and acid pickling came close behind. After them came a host of strand processes, galvanizing (previously done in the coil), tempering, and patenting. This was about a twenty-five year revolution, with the hot spot from 1855 to 1865, and it left the mills much as we found them at the turn of the century.

★ ★ ★

THE third revolution is the one we are still rotating in. We think it is about over; time will tell. We are too close to it for a just appraisal, but it seems to me that it started with the inhibitors, around 1918, and that the **Morgan-Connor** machine, coming in 1922, was the spark plug. The inhibitors cleaned up the pickle house and produced rods good enough for continuous work. Welded rods and artificial cooling followed promptly, and by 1928 we were getting eight or nine hundred pounds through cast iron dies. Continuous dry drawing was definitely over the hump, but along came the carbide die and hit the combination so hard that the issue was no longer in doubt. Nothing quite like the success of the carbides has occurred in wire mill history; within five years they rocketted from a curiosity to a necessity. When the story of this revolution comes to be written in proper perspective, the chances are that carbides will get the head lines.

Herbert B. Clark, General Sales Mgr., Vascoloy-Ramet Corporation, North Chicago, Ill.

★ ★ ★

THE astonishing speed and completeness of the carbide invasion was due to a combination of factors, chief of which was perhaps its timing. It started just after the big market crash of 1929, and for several years thereafter the mill staffs, though they had no money to spend, and very little business, had lots of time, and were under tremendous pressure to cut costs. The first man to grab the opportunity was **Morris Simons,** who came into the picture through the diamond die channel. Salesmen were a dime a dozen in those lean years, and he had the pick of the country. He assembled the most avid, hungry, and tireless aggregation ever known, backed them handsomely, and drove them hard. The founding of the Wire Association just at that time (1930) gave them a magnificent forum, and they, in appreciation, gave the new Association powerful support. Nobody will ever forget their lavish hospitality. They seemed, in those dark days, the only optimists left in a dying world.

★ ★ ★

IN 1929 only one man in ten had heard of carbides; in 1933 everyone had tried them; in 1935 everyone had adopted them.

★ ★ ★

THE new die originated in Germany during World War I, and was an "ersatz" product re-

sulting from the inability of the **Osram Company,** lamp manufacturer and drawer of filaments, to get diamond dies through the Allied blockade. These people were affiliated with **Krupp,** and the latter took over, first the marketing, then the production. It was in 1925 that these dies began to appear in America, where they had varying success in the copper mills. They were at first regarded as merely a diamond substitute, as indicated by the name **Widia,** a contraction of German words which mean "like a diamond." In the early days there was **Widia,** a sintered product, and **Wallramit,** a fused nib which proved too subject to porosity. Some feeble passes were made at the dry drawing field, but without the flowing liquids of the copper mill the dies heated so much that the brass casings expanded away from the nibs, which promptly cracked. This casing matter was troublesome for several years, but the problem was solved in various ways. I will run through some of the early developments chronologically.

★ ★ ★

—1926—

MULHEISEN, of Philadelphia, took the agency for **Wallram** dies, from a **Krupp** affiliate, and had little luck. In this year I came upon the **Elmarid** dies, bought a set for five hole 14 and carried them all over this country and Europe. From time to time I would draw a few thousand pounds with them on a **Morgan-Connor,** just to keep the interest up. These were steel-cased dies, the first I had seen.

★ ★ ★

—1928—

DOUGLAS HARVEY, president of **Reynolds Wire Co.,** travelled in Germany, visited Krupp, and brought back some carbides for weaving wire. I visited Krupp the same year, liked the prospects, and became a booster for the dies.

★ ★ ★

A SIGNIFICANT event took place this year. **American Brass Co.** bought a lot of dies, found the angles wrong, and hired **Morris Simons,** the diamond merchant, to recut them. Mrs. Simons didn't raise any dumb children; Morris read the score, jumped the boat for Germany, and secured the **Widia** agency. He promptly bought out his **Unwidia** dies, the first two letters being suggestive of his **Union Wire Die Co. Elmarid** dies were coming out of **Mannheim,** and **Urdika** from **Duesseldorf,** but they both subsided, whether scared off or bought out I never knew.

★ ★ ★

THIS same year **General Electric** made a deal of some sort with **Krupp.** I never could get a clear statement regarding this situation; I think it was at first a deal relating to the G. E. mills alone, but it soon broadened and presently **Carboloy (G. E.)** and **Unwidia** were competing on equal terms. (I recall that **Osram** was an affiliate of International General Electric).

★ ★ ★

—1929—

IN this year **Simons** started operations on his own, and at the same time **Koebel** and **Wagner** began, in Newark, to turn out dies for **Carboloy. Jim Longwell** came into the Carboloy organization, and started development work at the lamp works in Cleveland with **Benbow,** who, though he never came out from behind the scenes, was a powerful factor in die development.

★ ★ ★

—1930—

THE matter of casings was by this time under fair control, and some decent quantities of carbide dies began to go into service. **American Brass** at Waterbury went in on a large scale, and **Union Drawn Steel** and **Wickwire-Spencer** at Palmer placed good orders. A word or two is in order regarding these last two concerns. Union Drawn sank $7000 in the dies, which, a few days later, disappeared. Seven years later while tearing down an old garage workmen found all these dies under the floor. Wickwire lost the whole consignment within a few days. Some days later **Supt. Carl King,** while crossing a footbridge over the Quabog, saw some odd spots on the ice that bordered the stream, and on closer view found they were dies. When the water had warmed up a bit in the spring he put a man in and dredged up 3000 dies. Wire drawers, like most mechanics, have an instinct that warn them of impending revolution.

★ ★ ★

AT this time **Ludlum Steel Co.** brought out **"Strauss Metal"** dies, whose only interest for us lies in the fact that they engaged **Abe Simons** (brother of Morris), to make the dies, thereby bringing him into the field. **Firth-Sterling** came in with carbides of their own, with **Brown** of **Detroit Wire Die** doing the mechanical work. **Teco** jumped in, with **Storrs** as pilot. The Wire Association was started.

★ ★ ★

TAKING a quick look over the principal die concerns, it appears that each had some experience or some position in the industry that led naturally into this line. Nobody jumped in cold. Some were diamond die merchants or polishers, and saw themselves in danger of being crowded out. The **Simons** brothers are in this class. Some, like **Teco (Tungsten Electric Co.),** had tungsten connections, or, like **Vascoloy-Ramet,** rare metal refining experience. **Firth** had tungsten mines, and were already deep in die steel. **Carboloy** had, in **G. E.,** not only a big copper wire business, but a tungsten filament plant of giant size.

★ ★ ★

AT this time the late **Frank Nullmeyer** of Youngstown took a deep interest in the dies, and gave much valuable help and encouragement to the sponsors, as did also **Walter Stone** at Interstate.

★ ★ ★

—1931—

NOW the mills began to come around in earnest; perhaps the **Wire Association** was beginning to pay off. Here are some of the mills and personalities prominent in that year: **Pittsburgh Steel,** with **King** and **Breining, Youngstown,** with **Nullmeyer** and **Shilling, Continental,** with **Clifford, Indiana,** with **Crapo** and **Holmes, Seneca,** with **Kinn, Wilson,** with **Grassell,** and doubtless others that I have

forgotten. With the backing of **Johns** and **Preston, Walter Dennis** put **Page** in. **Jack Mordica** was a godsend to the die men. After a brief test he stuck his neck right out, waiving all further safeguards and guarantees. **Dwight Granger** is mentioned with gratitude by die men for his cooperation and help in the dark days.

★ ★ ★

—1932—

PAFF, at **Wheeling Steel,** dove in at this time, with the help of **Walter Dennis. Aliquippa** got in line, **Glen** and **Duthaler** were the midwives, with **Hussey, Carr, Sanders,** and **Eberle** cooperating. I am not attempting to assign plants to the different die staffs, my chief reason being that often, after one organization had done the spade work and got well started, a run of hard luck with porosity, cracked casings, or perhaps some politics or reciprocity among the high brass, would supervene, and a competitor would fall heir to the crown. It was heart-breaking, but so far as I can see it worked to a pretty fair balance in the long run. I used to say, in those days, when asked to recommend a die, "go along with the service man you like best to work with."

★ ★ ★

REGARDING the business side of the picture, this was a time of utter confusion. The consensus was, and it was the only thing on which there was agreement, that these dies were pretty sure to come along; the question was how to introduce them. The mills were broke. If the dies were loaned, they would be reserved for hard spotted, dirty, off-heat rods, where they would save the mill a lot of money but not make the sort of showing that would impress the high brass. The die companies were ready to finance the mills, if any way could be found to do it. Finally, after various leasing schemes had blown up, the die companies set up their shops right in the mills, and supplied dies at a flat rate per ton of wire drawn. That straightened everything out. The records were open, and when the owners saw how much money the die men were taking out of the mills they stepped in and took over. As soon as they accepted the dies whole-heartedly, and stopped trying to keep meticulously accurate records for rebating purposes, the savings became apparent to the meanest intelligence.

★ ★ ★

A FEW more dates and I am done. In 1932 **Zapp** and **Elias** went over from **Union** to **Firth,** and put them into the business right. **Vascoloy-Ramet** started up, sparked by **Walter Dennis.** Next year the **Corporation** succumbed, and installed a central depot at Cleveland. That should have been the tip-off; when the **Corporation** pats a stranger's baby on the head, that baby is in the money. In 1934 **Ludlum** dropped out, and **Abe Simons (Master Wire Die Co.)** came into the picture on his own. By 1935 the pioneering was definitely over; those few who still held out against carbides were on the defensive. The subsequent history, while interesting to the expert, is not for us.

★ ★ ★

NOW that the smoke of battle has to some degree cleared away, perhaps it is time to appraise some of the personalities involved. It is the personalities that seem to make these stories come to life. I'm sure I don't know why. A lot of good men poured out their blood, sweat, and tears over this revolution, it is true, but not for love of humanity, or a feeling of obligation to the wire industry. They were just trying to get along, and they functioned more or less efficiently, according to the equipment the good Lord endowed them with, rather than in ratio with their devotion to their fellow-man. As a philosopher I know that we owe these fellows nothing; but as a human being, and a wire man, I am deeply grateful to them. Let me pass out a few compliments.

★ ★ ★

IT was the devil's own luck for the industry that **Morris Simons** got in at the start. His faith in the product and in himself during the dark days was nothing short of sublime. He was ready, willing, and able, to finance the wire mills during the critical period; he stuck out his neck, paid out enormous sums for the purchase of the quota of carbide called for by his contract, and drove his hungry salesmen like Simon Legree till they made good for him. He was terrific. Did you ever see a fat die salesman? No. Morris ran the lard all off them. Here is a partial list of the alumni of the **Morris Simons Institute for Reducing the Figure:**

★ ★ ★

Woodford	**Now with Corundum Co.**
Jacobson	**Died**
Zapp	**Went With Firth-Sterling**
Elias	**Went With Firth-Sterling Now dead**
McCoy	**Went With Firth-Sterling**
Roth	**With Vascoloy-Ramet**
Clark	**With Vascoloy-Ramet V. P. & Gen'l Mgr.**
Storrs	**Vice Pres. Teco.**
Muldoon	**Went to Carboloy**
Bronson	**Went to Carboloy**
Mock	**Went to Carboloy**
Duncan	**Went to Carboloy**
Paharick	**Now With Allied Mfg. Co.**

★ ★ ★

TWO very important figures in carbide development were **Jacobson** and **Elias.** They lacked, it is true, the solidity and depth of such men as **Longwell** and **Duncan,** but they could accept and sift the findings of other men, sounder analysts, and peddle them with true missionary fervor and zeal. They never admitted defeat. No matter how screwy their arguments, how tenuous their toe-hold in a plant, nothing ever discouraged them; nobody ever talked them down. They were what the carbide die needed at that time, and in any true appraisal of personalities they rate a high place.

★ ★ ★

I ALWAYS thought **Jim Longwell** was the best posted technical man in the industry, but there may have been modest figures I never came across. **Gus Zapp** and **Herb Clark,** the Grand Old Men of the industry, were triple-threat men, equally effective in technical, sales, and executive work. **Herb** was in so many places at once that in the early days I thought there were three Clarks, and often wondered how they were related. Herb

(*Please turn to page* 105)

LABOR RELATIONS

By John B. Stone
Washington, D. C.

The twenty-first in a series of articles on the subject, with particular reference to problems of the wire and wire products industry. The author is a noted authority on the subject.

POST election developments indicate that those manufacturers who feared a sweep of radical labor-management legislation would make it impossible for them to do business, were misjudging the situation. It appears to veteran observers here that though the Taft-Hartley law may be repealed, substitute measures will be passed to retain in federal labor policies, many of the features desired by employers.

★ ★ ★

ANOTHER development in pre-Congressional maneuvering in the Capital may have consequences of even more importance to small and medium sized manufacturers including those who produce wire and wire products.

★ ★ ★

THIS latter development affects the Bureau of Labor Statistics in the Department of Labor and its appropriations. For many years prior to the war there had been a carefully nurtured movement to develop the cost of living and other reports from the Bureau of Labor Statistics, as a sort of fundamental measuring rod for use in wage negotiations.

★ ★ ★

THE Eightieth Congress, however, cut the bureau's appropriations by more than 35 per cent. As a result many of the very statistics which both labor and industry had grown to rely upon for use in negotiations were in danger of being cut off. It is regarded in the Capital as practically certain now that these appropriations will be restored to 1944 levels and perhaps even increased.

★ ★ ★

THIS is of particular interest to smaller manufacturers because the bureau is planning to extend its cost of living surveys to give an accurate picture of local conditions and local wage needs in various parts of the country.

★ ★ ★

THERE is another element in the situation which may also work to the advantage of manufacturers. The cost of living survey is a great benefit to employees in times of rising prices and inflation. However, it is of equal importance to the manufacturer when prices are going down. He is put in a position of strength in demanding wage reductions by the very figures which in an upward price spiral work for the benefit of his employees. Nearly all economists here agree that prices generally speaking, will either level off soon or start a gradual downward trend. Some even predict a precipitous drop in many lines.

★ ★ ★

IN the matter of general labor legislation there seems to be little doubt now that some law will be retained which will continue to prevent labor unions whose leaders decline to sign affidavits declaring they are not Communists from reaping the benefits of the National Labor Relations Board.

★ ★ ★

THIS is more important than it may seem to a manufacturer giving it only scant attention. A review of the workings of the law during the last year, shows that many manufacturers have been able to get rid of unions they regard as unreasonable and unreliable through the workings of this law. The law makes it possible for union leaders who make it a point to get along with "the boss" to oust their rival unions and set up working arrangements more acceptable to the employers. Even leaders of the two big labor federations indicate that they will put up little if any opposition to retention of the law.

★ ★ ★

THE American Federation of Labor at its annual convention came out flatly for retention of the provision. Although Philip Murray president of the Congress of Industrial Organizations and also chief of the United Steel Workers is on record against the law, his actions indicate otherwise.

★ ★ ★

MURRAY has given unlimited support to "anti-red" unions within the CIO which have contested plant jurisdictions with left wing unions in the same federation. For instance, at Murray's direction the left wing, Farm Equipment workers were ordered to merge with the anti-Communist United Auto Workers. The United Public Workers and the American Communications Workers, both left wing, face annihilation if they fail to dump present leaders.

★ ★ ★

AND it is equally important to note that the Administration in Washington and its followers in Congress have declared that they must retain the injunction right against nation-wide strikes which cripple or threaten public welfare.

★ ★ ★

ALL in all the prospect for peaceful labor relations between smaller and medium sized manufacturers and their employers appears to be brighter, rather than more bleak, since the November elections.

★ ★ ★

1948 ASTM Standards on Copper And Copper Alloys

THE 1948 ASTM Standards on Copper and Copper Alloys, includes the 106 standard specifications, test methods and definitions, covering copper and copper-base alloy products, developed by Committee B-5 on Copper and Copper Alloys and ASTM technical committees.

* * *

THERE are 16 specifications covering copper and copper-alloy wire and cable. Products covered include hard-drawn; medium-hard-drawn; soft or annealed; copper trolley; bunch-stranded copper conductors; hot-rolled rods; and figure-9 deep-section grooved and figure-trolley wire.

* * *

THREE specifications for alloy conductors are hard-drawn copper-covered steel; concentric-lay stranded copper-covered steel; and concentric-lay stranded copper and copper-covered steel composite.

* * *

TWELVE specifications cover copper and copper-alloy plate, sheet and strip, including specifications for brass; gilding metal; aluminum and phosphor bronze; copper - nickel - zinc and copper-nickel alloy, beryllium-copper alloy; copper-silicon alloy; and copper sheet, strip, and plate.

* * *

COPIES of this 516-page book, heavy paper cover, can be obtained from ASTM Headquarters, 1916 Race Street, Philadelphia 3, Pa., at $4.35 per copy; cloth binding, $5.00.

* * *

Half-Century Anniversary Catalog

THE **American Nickeloid Company,** Peru, Illinois, pioneers in preplating metals, has marked their fiftieth anniversary by issuing a souvenir booklet telling of their early struggles and achievements in this period.

* * *

BESIDES the historical data, the Company has included descriptions of their various metal platings on steel, brass, copper, zinc, tin and aluminum.

* * *

COPIES are available to those interested.

* * *

Gilron Acquires Pickling Business In Detroit

GILRON **Products Co.,** Cleveland, Ohio, have purchased and are operating **All-Metals Pickling Corporation,** 3631 Parkinson, Detroit, Mich., which handles pickling jobs on all types of metals for customers on a job or contract basis. The new owners are Gil Orozco and Ron Whitbeck.

* * *

Produces Corrosion Resistant Valves for Industrial Liquids

THE **Acimet Valve Mfg. Company,** 1529 East 49th Street, Cleveland, 3, Ohio, has issued Catalog A, covering a line of valves that are made of lead, to resist corrosion in the handling of acids. These valves, the result of 50 years' of experience are cast from a hard lead alloy that is free from copper and antimony and therefore provide the utmost in corrosion resistance. Catalog A will be sent to interested parties on request.

* * *

MICROMETER PRECISION

MICRO-WELD

TRADE MARK REG. U. S. PAT. OFF.

MODELS J-3-C and J-4-C AUTOMATIC

These welders are used for welding COPPER, ALUMINUM, and other non-ferrous wire ranging in size from .031" to .128" diameter.

The welding cycle on these welders is automatically controlled and completed by a single downward stroke of the foot pedal, which include the clamping of the wire being welded, contacting the welding switch, and applying the upset pressure on the weld.. All units are equipped with annealing dies, filing vise, light, extension cord, and mounted on a 4-wheel truck.

MICRO PRODUCTS COMPANY

20 NORTH WACKER DRIVE, CHICAGO 6, ILL.

Telephone, State 2-7468

made of
KEYSTONE WIRE

Heavy double ring construction gives Extractor Tire Chains double wear, double traction. The double rings lie flat when traction is not needed . . . prevents damage to concrete or grassy fields . . . and gives a smoother ride.

Tractor chains must be huskily built to withstand the powerful wheel thrusts . . . the chain links must be tough and strong. Extractor Chains are formed from extra brite Keystone Wire that has excellent welding qualities as well as proper ductility for easy forming and twisting. The wire has favorable heat-treating and hardening characteristics that count for abrasion resistance and long wear.

Yes, we are proud that sturdy Keystone Wire is such a major factor in the fine construction of Extractor Tire Chains.

** Nixdorff-Krein Mfg. Co.*
St. Louis 6, Missouri

KEYSTONE
MUSIC SPRING WIRE
KEYSTONE STEEL & WIRE CO.
PEORIA, ILLINOIS

SPECIAL ANALYSIS WIRE
for all industrial purposes

KEYSTONE STEEL & WIRE COMPANY
PEORIA 7, ILLINOIS

Three Nations Sign Screw-Thread Pact

AN 80-year barrier to industrial and military cooperation between the United States, Great Britain and Canada was removed in Washington on November 18 when representatives of the three nations met at the National Bureau of Standards to sign an agreement unifying standards for screw threads and other threaded components used throughout industry.

★ ★ ★

SECRETARY of Commerce Charles Sawyer highlighted the significance of the agreement by pointing out that "practically everything we use that is made of more than one piece of metal is put together with nuts or bolts or other screw-threaded machine elements."

★ ★ ★

THE agreement provides that the nuts, bolts, screws and other threaded machine parts made in the three countries will henceforth have a 60 degree thread pitch, as is used in the American Sellers standard adopted in 1864. This represents a departure by the British from their 55-degree Whitworth thread angle which has been standard in the U. K. since 1845. The standardized screws will have a rounded root, as in the previous British standard, while the crests of screws may be either rounded or flat. The compromise makes nuts, bolts and screws of the three countries interchangeable.

★ ★ ★

AUTHORITIES of the American Standards Association, Society of Automotive Engineers and American Society of Mechanical Engineers and British and Canadian representatives have been negotiating for such an agreement since the end of the first World War. Efforts to reach an agreement were abandoned in the 1920's.

★ ★ ★

THE changeover to the new standard will be made gradually, as new models of various products are brought out and as existing tools, dies, taps and gages wear out.

★ ★ ★

COPIES of the report are being sent to members of the fastener industry, but if you have not received yours, you may address the National Bureau of Standards, U. S. Dept. of Commerce, Washington 25, D. C., asking for a copy of Technical Report 1315.

★ ★ ★

New Ice Freezing Floor for Madison Square Garden

MADISON Square Garden, scene of many extravaganzas, is itself a colossal structure. Maintenance and replacement on the building and equipment are often done on a scale as big and impressive as the sporting events themselves.

★ ★ ★

A NEW concrete-embedded piping system for freezing ice, for example, included the laying of 13 miles of 1¼" galvanized wrought iron pipe placed 4" on centers over the entire arena floor. An innovation in this new piping system involved the use of 3,000 EASY-FLO brazed Flagg-Flow threadless malleable iron fittings which were used to join the 20 and 40-ft. lengths of pipe.

★ ★ ★

ONE of the important advantages of this relatively new method of joining iron pipe is the retention of full wall thickness of the pipe, and consequently, full strength of the pipe by eliminating thread cutting.

★ ★ ★

LEAK-TIGHT joints were obtained between pipe and fittings by sweating in the high strength silver brazing alloy with oxy-acetylene-torches.

★ ★ ★

I. S. A. Convention Locations for 1949 and 1950

THE Board of Directors of the Instrument Society of America decided the selection of the locations for its National Conference and Exhibit for the next two years, at the recent meeting in Philadelphia.

★ ★ ★

THE 1949 Convention will be held in the Municipal Auditorium, St. Louis, September 12-16, 1949. Buffalo was selected for the 1950 Instrument Conference and Exhibit, which will be held in the Buffalo Auditorium, September 11-15, 1950.

MANY SHAPES, MANY FINISHES
. . . For Thousands of Uses!

Quality control at Seneca allows you to plan production without future worries about material variations. Iron, steel, low carbon, high carbon, tempered or untempered, aluminum and bronze wire are all produced according to the same high standard.

● *Shapes*

Square—Keystone—Flat-Round—Half-Round—Special Shapes—Straightened and cut.

●● *Sizes*

Number 40 W & M Gauge (.007) and larger.

●●● *Finishes*

Liquor Finish—Bright Galvanized—Coppered—Enameled All Colors—Annealed—Tinned—Oil Tempered.

●●●● *Thousands of Uses*

Aircraft	Cable	Hair Pin	Reed
Armor	Car Seal	Hat	Regulator Spring
Armature	Clips	Hat Pin	Ribbon
Bee	Clock Spring	Heddle	Safety Pin
Belt Hooks	Cotter Pins	Hooks and Eyes	Spark Coil Core
Bobby Pins	Curtain Springs	Link Fabrics	Special Springs
Bonnets	Drapery Pin	Lock Springs	Spiral Binding
Bookbinders	Fish Hook	Mattresses	Stapling
Bottlecap	Fish Tape	Needle	Stitching
Box Stitching	Florist	Picture Cord	Umbrella
Brooms	Fuse	Pins-Ropes	Valve Spring
Brushes	Glass Netting	Pin Ticket	Weaving
Button	Grape Tying	Piston Ring	Wire Cloth
	Gutter Broom	Plow Steel	

Save time and money by depending on Seneca Quality Controlled Wire to meet your specifications. Write today for quotation and delivery schedule.

SENECA
WIRE & MANUFACTURING COMPANY
FOSTORIA, OHIO — ESTABLISHED 1905
REPRESENTATIVES AND WAREHOUSES IN ALL PRINCIPAL CITIES

REELS of WOOD

RETURNABLE
and
NON-RETURNABLE

Furnished assembled or knocked down, made to your specifications. Will withstand severest handling. Sturdy, strong, low in cost. Made for

CABLE,
ROPE and
WIRE

Made in any size, from
12" to 96" in diameter.

ALSO, REEL HEADS FOR STEEL DRUMS

Send us your specifications
and let us quote on costs.

BRIDGE MFG. CO., Inc.

HAZARDVILLE CONN.

Book Review
Prevention of Iron and Steel Corrosion

THERE exist in the world a considerable number of processes and published specifications relating to the prevention of the corrosion of iron and steel. This book is an attempt to compile a complete index of such methods and the standard specifications connected therewith. It is therefore a work of importance to very many people who hitherto have had no compact and easily accessible form of reference.

★ ★ ★

FOR convenience the matter is divided into three parts dealing respectively with methods of preventing corrosion (broken down into eleven groups), cleaning metal parts and codes of practice. The two appendixes deal with authorities issuing specifications and with paint and paint component specifications—the latter especially will be of considerable practical value to a wide circle of readers.

★ ★ ★

AGAINST a background of industrial requirements, the author has produced something of importance to engineers and others who are concerned with the preservation of machinery. He has had the co-operation of such bodies as the Ministry of Aircraft Production, Armament Research Department (Woolwich), British Standards Institution, B.I.S.R.A. Corrosion Laboratory, Research Association of British Paint, Colour and Varnish Manufacturers, British Cast Iron Research Station, D.S.I.R. Chemical Research Laboratory, etc.

★ ★ ★

COMPILED by C. Dinslale, Msc., F.I.M. and published by the Louis Cassier Co., Ltd. Dorset House, Stamford St., London, S.E.I. England.

★ ★ ★

New Publication on Scientific Equipment

EBERBACH and Son Company, Ann Arbor, Mich., have published a new edition of the Announcer, No. 48-10-32, covering laboratory equipment for the technical research man. Copies may be secured by writing the Company.

Outstanding Personalities of the Wire Industry

Angier Corporation Appoints L. S. Kimball General Manager

ANGIER CORPORATION, Framingham, Mass., manufacturer of waterproofed and reinforced papers for building and industrial packaging applications, including coil wrapping papers and machinery for wire manufacturers, announces the appointment of **Louis S. Kimball** as general manager. In this capacity Mr. Kimball will direct Angier's revised distribution program required for their newly developed products in expanding markets.

★ ★ ★

PREVIOUSLY, Kimball served in key manufacturing and sales positions with Frigidaire Division of General Motors, Corp.; Sylvania Electric Products, Inc.; Colonial Radio Corp.; and more recently with Bell Aircraft Corp. as sales manager of the Prime Mover Division. Kimball was graduated from Dartmouth College ('25) Magna Cum Laude.

★ ★ ★

L. S. Kimball, Gen. Mgr., Angier Corp., Framingham, Mass.

OTHER Angier Corporation officers are **E. H. Angier,** Chairman of the Board; **John M. Angier,** President; and **A. J. Thiel,** Treasurer.

★ ★ ★

Nilsen Engineering Company to Represent Airmatic Valve, Inc., In New England

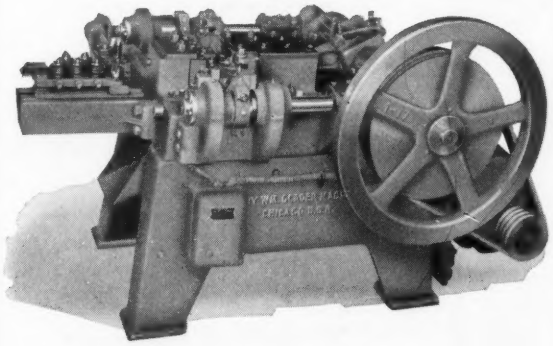
LARRY GARDNER, president of Airmatic Valve, Inc., Cleveland, Ohio, announces the appointment of the Nilsen Engineering Co., 101 Washington St., Salem, Mass. as exclusive representatives in the six New England States.

★ ★ ★

AIRMATIC Valve, Inc., manufactures a complete line of automatically controlled vacuum, pneumatic and hydraulic valves for the automatic control of mechanical machines and equipment.

★ ★ ★

GLADER HIGH SPEED WIRE NAIL MACHINE



MACHINE ARRANGED FOR INDIVIDUAL MOTOR DRIVE

High tonnage output, and low maintenance costs, have resulted in Glader Machines being accepted as standard equipment in every large nail mill built in the United States in the past twenty years.

Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

For further information please address,

WM. GLADER MACHINE WORKS
210 No. Racine Ave.
Chicago 7, Illinois

Export Dept.: 122 E. 42nd Street, New York 17, N. Y.

Radway Becomes Division Superintendent for A. S. & W., Cleveland

CARL L. RADWAY has been appointed division superintendent, cold rolling mills at the Cuyahoga Works, Cleveland, Ohio, of **American Steel & Wire Co.,** U. S. Steel subsidiary. He succeeds C. M. Sackerson, deceased.

* * *

MR. RADWAY is a native Clevelander, having been born there in October, 1893. He attended Case Institute of Technology before joining the American Steel & Wire Co., in 1912 as a gas washer at Central Furnaces in Cleveland. He left the company in November, 1913, and upon rejoining American Steel and Wire in March, 1916, he was transferred to the Cuyahoga Works as foreman in the flat cleaning department. All of his experience since that time has been at Cuyahoga Works where since January, 1946, he has been department superintendent, production planning.

* * *

J. P. Williams, Jr., New Pacific Coast Representative for Apco Mossberg Company

THE Apco Mossberg Company, of Attleboro, Mass., announced that **Jack P. Williams, Jr.,** has been appointed their Pacific Coast Representative with offices in the Matson Building, 215 Market St., San Francisco, 5, California.

* * *

MR. WILLIAMS for many years was connected with the National Pneumatic Corporation and has also been affiliated with Syncro Machine Company.

* * *

Dr. James R. Donnalley Appointed Manager of the G-E Waterford, N. Y., Plant

APPOINTMENT of **Dr. James R. Donnalley** as manager of **General Electric's** silicone manufacturing plant at Waterford, New York, has been announced by John L. McMurphy, manager of the Chemicals Division.

* * *

A NATIVE of Camden, New Jersey, Dr. Donnalley was graduated from Pennsylvania State College with a bachelor of science degree in chemical engineering. He received his Ph.D. in 1943 in chemical engineering from Cornell University.

* * *

IN November of 1943, he joined the Company in the chemical section of the Research Laboratory, working on fundamental silicone chemistry. In July of 1944, he was loaned to the Resin and Insulation Materials Division where he worked on pilot work for silicones and on the design of the Waterford plant. In April of 1946, he was transferred to the Chemical Engineering Division of the Chemical Department, taking charge of the Waterford group.

* * *

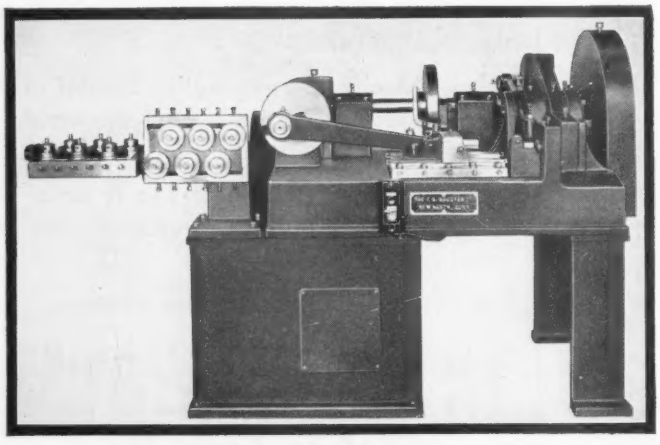
Norton Company Appointments

NORTON COMPANY has announced the following changes in the personnel of their **Norbide** Division.

* * *

AUTOMATIC SLIDE FEED MACHINES

Straighten and Cut Round or Shaped Stock



These machines are especially recommended where accuracy and a square cut are essential. The machine shown straightens and cuts up to 3/8" stock from coils, 10" maximum length of cut; 1/2" capacity also available. When writing, give full details of your requirements.

METTLER MACHINE TOOL, INC.

SHUSTER WIRE MACHINE DIVISION
132 W. Lawrence St., New Haven, Conn.

JOHN W. McCUE has been transferred to the abrasive division training course from his territory in Chicago.

★ ★ ★

GEORGE H. POWERS who has covered the New England territory, will take over the Chicago area.

★ ★ ★

SHELDON V. COLEMAN, formerly of the sales department in Worcester, has been appointed boron carbide engineer in the district recently occupied by Mr. Powers.

★ ★ ★

NORTON Company also announces changes in their abrasive Division sales force.

★ ★ ★

A. W. COX, formerly abrasive engineer in the St. Louis area has been shifted to a newly established territory in southern California.

★ ★ ★

E. H. STYFFE, abrasive engineer moves from Pittsburgh to take over Mr. Cox's responsibility in St. Louis.

★ ★ ★

CHARLES H. KRANE, formerly field engineer in Connecticut has been appointed abrasive engineer and will cover the territory vacated by Mr. Styffe in Pittsburgh.

★ ★ ★

Oliver Iron & Steel Appointments

OLIVER Iron and Steel Corp., Pittsburgh, announces appointment of **Allyn E. Harper** as chief plant engineer. He formerly was plant engineer, General Cable Corp., St. Louis. Other appointments are: **William N. Boyd,** superintendent, industrial fasteners manufacturing; **Martin Schmunk,** chief inspector; **Albert M. Schmidt,** assistant chief inspector; **William G. Lehrman,** superintendent, receiving warehousing and shipping; and **Howard F. Kunkle,** superintendent, maintenance and die shop.

★ ★ ★

R. D. Harkness Succeeds P. F. Sise As President

PAUL F. SISE, president of Northern Electric, Montreal, Canada, for the past twenty-nine years, tendered his resignation at a meeting of the board of directors held on October 28. Mr. Sise's resignation became effective November 30, at which time he became chairman of the board of directors.

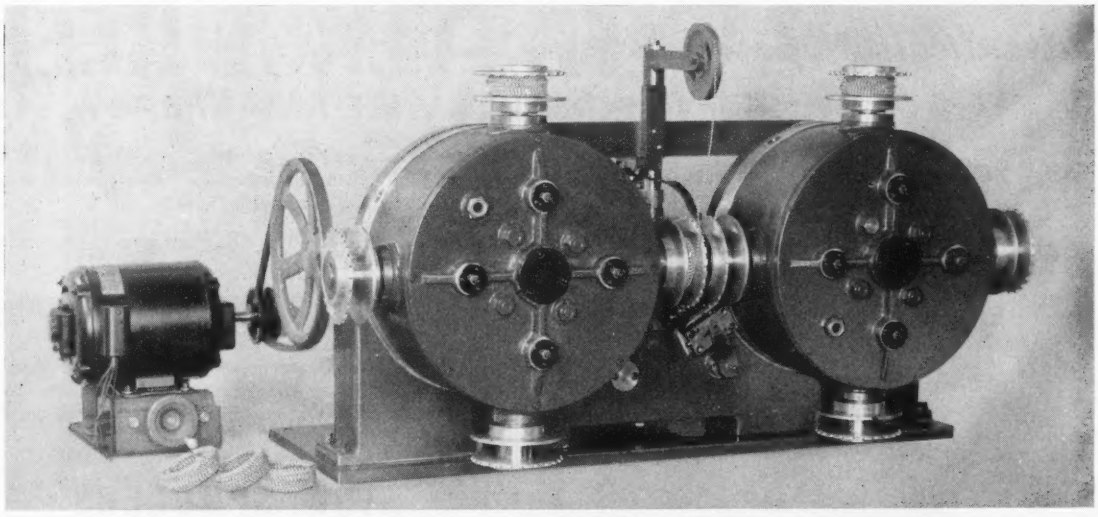
★ ★ ★

SUCCEEDING as president of the company is **Col. R. Dickson Harkness,** D.S.O., M.C., vice-president, general manager, and director since 1938.

★ ★ ★

MR. SISE joined the Northern Electric and Manufacturing Company in 1904. He became managing director in 1910, and four years later, when this company merged with the Imperial Wire and Cable Company to become Northern Electric Company Limited, he was appointed vice-president and general manager.

★ ★ ★



CONTINUOUS COIL WINDER MODEL 3130

This modern machine of new design is best used for winding short coils (up to 200 ft.) of soft or hard wire. Production is limited only by speed of operator and the coils can be produced in quantities of 200 to 400 per hour. Write for circular of this and many other models of spoolers.

Our engineering representative is always ready to discuss the use of our equipment for solving your production problems.

BOYD-FIDELITY SPOOLERS
CHARLES P. BOYD CORPORATION
1434-38 Callowhill St. Philadelphia 30, Pa.

J. T. Gillespie, Jr., Appointed Sales Manager of Watson-Stillman Company

J. T. GILLESPIE, JR., has been appointed sales manager, **Watson-Stillman Co.,** Roselle, N. J., which he joined in 1944 as director of export sales. In his new position he will continue to supervise the company's export sales. For 10 years prior to joining Watson-Stillman Co. Mr. Gillespie held sales and administrative positions with Air Reduction Co. Inc., New York, and its subsidiary, Wilson Welder & Metals Co., where he was assistant to the president. For three years of World War II he was on loan from Air Reduction Co. to the government.

★ ★ ★

Industrial Ovens Appoints V. C. Leatherby Pittsburgh District Engineer

V. C. LEATHERBY was named Pittsburgh District Engineer for **Industrial Ovens, Inc.,** Cleveland, Ohio in an announcement by C. A. Litzler, President, appointing him as the company's representative in Western Pennsylvania. Mr. Leatherby brings to this new association a successful career as sales engineering representative in Pittsburgh and Cleveland for companies in lines allied to Industrial Ovens activities in the industrial heating and processing fields. He maintains offices at 908 Peoples East End, Bldg., Pittsburgh, Pa.

★ ★ ★

Jessop Steel Company Appointments

CARL J. MURRAY has been appointed general superintendent, **Jessop Steel Co.,** Washington, Pa. He formerly was assistant manager of Colorado Fuel & Iron Corp. **Edward J. Sherrill** has been named superintendent of production scheduling and shipping; **Ellsworth E. Seitz,** director of personnel relations; **Norris B. McFarlane,** superintendent of electric furnace department; **Edwin C. Thomas Jr.,** superintendent of bar mills; and **James O. McDowell,** superintendent of sheet mills.

★ ★ ★

Fab-Weld Corporation Adds to Material Handling Sales Staff

STEPHEN A. FOSTER and **Gordon H. Collum** have just joined the Philadelphia Material Handling Sales Department of Fab-Weld Corporation.

★ ★ ★

MR. COLLUM was formerly associated with Gates Rubber Company, Denver, Colorado and Mr. Foster was connected with the Navy Department.

★ ★ ★

Mathew R. Rosse

MATHEW R. ROSSE died at the Mountainside Hospital, October 7 after a brief illness. He was fifty years old. At the time of his death he was Export Manager of The Colorado Fuel and Iron Corporation. He was associated with the exportation of steel products and industrial equipment for twenty-five years.

★ ★ ★

HIS passing is deeply regretted by all of his associates.

★ ★ ★

Hydraulically Operated **TRAVERSE REELS**

FOR FLAT WIRE AND NARROW STRIP

• The self-contained, compact SECO Traverse Reel has smooth, powerful hydraulic operation — at speeds from 150 to 600 feet per minute.

PERFECT SPEED CONTROL from zero to top running speed through flow control.

ACCURATE TENSION CONTROL through pressure regulation.

Built in sizes for coils weighing up to 600 lbs., for round or flat wire. Unit shown occupies floor space 24" x 42". Modifications in design and construction to meet specific requirements.

WIRE SPOOLERS

Single and Multiple Type

Speeds Up To 4,000 feet per minute

STEEL EQUIPMENT CO.

SECO 2890 EAST 83rd STREET CLEVELAND 9, OHIO

Nopco Staff Changes

JOHN J. McCLOSKEY, JR., will represent the Industrial Division of **Nopco Chemical Company,** Harrison, N. J., in the Central Atlantic States, which will include Maryland, Virginia and West Virginia. He is the Captain McCloskey referred to in the March, 1948, Reader's Digest in "Captain McCloskey's Mission."

★ ★ ★

JOHN J. RYAN, formerly in the Company's Laboratories in Harrison, is now a member of the Eastern Area sales staff. He succeeds Walter E. Brewer, recently promoted to district sales manager.

★ ★ ★

WILLIAM A. McCREADY is an addition to the Central Area sales force for the Industrial Division, which will include Indiana, Kentucky and sections of Ohio. Besides the processing chemicals of Nopco, he will handle metallic soap products.

★ ★ ★

Aldus Chapin Higgins

THE NORTON COMPANY, Worcester, Mass., has issued a memorial brochure to commemorate the long association of **Aldus Chapin Higgins** with their Company. Mr. Higgins whose death occurred on September 10th, 1948, had served the company for nearly fifty years, during which time he served in many capacities, including those of president, chairman of the board and chairman of the executive committee, the post held at the time of his death.

★ ★ ★

THROUGH his technical knowledge, business acumen and personal example he helped guide the Norton Company to its pre-eminent position as the world's largest producer of abrasive products. Under his guidance the first water-cooled electric furnace, making possible the commercial production of aluminum oxide (alundum), was developed among his many contributions to modern industrial processing.

★ ★ ★

JUST prior to his death, on August 30th, the Company dedicated a new $4,300,000 grinding wheel plant, said to be the largest in the world.

★ ★ ★

Wire Machinery Builders Association Annual Meeting

AT the annual meeting of the **Wire Machinery Builders Association** held in New York City on November 29th, 1948 the following officers were elected:

President ..... L. A. Vaughn
Vice President ..... Clayton F. Fisher
Vice President ..... John A. Kreitler
Sec.-Treasurer .. F. S. Van Valkenburg

★ ★ ★

AT this same meeting **Philip Morgan** retired as president after many years of faithful service to the association and was extended a vote of thanks by the association.

★ ★ ★

WILLIAM KELLY, President of Machinery and Allied Products Institute, was present as a guest.

★ ★ ★

The SPECIALISTS in Wire-Straightening and Wire-Cutting!

Diameter Range — 1/16" to .005"

PRECISION - Our Motto

DON'T hesitate to call on us when you are confronted with wire-straightening problems involving close tolerances and absolute accuracy. For seventeen years we have specialized in straightening and cutting all gauges of fine wire, hard or soft, ranging in diameter from one-sixteenth of an inch down to five-thousandths of an inch. We employ gun-barrel accuracy in straightening lengths from one inch to ten feet or any fractional part thereof. Ends cut absolutely clean without burrs.

ASK ABOUT OUR UNEXCELLED FACILITIES FOR CLEANING AND POINTING WIRE ALREADY STRAIGHTENED AND CUT.

ALL TYPES OF WIRE...

- Nickel
- Stainless Steel
- Bronze
- Brass
- Copper
- Alloy Wire
- Music Wire
- Tag Wire
- Florist Wire

Write us today!

Manufacturers of the famous ARMA PAPER CLIP

PITTSBURGH CUT WIRE COMPANY

1112-20 GALVESTON AVENUE · PITTSBURGH, PENNSYLVANIA.

TELEPHONE: CEdar 4702

A Review of Recent Wire Patents

NO. 2,452,948, COAXIAL CABLE, patented November 2, 1948, by Louis H. Morin, Bronx, N. Y., assignor of one-half to Davis Marinsky, Bronx, N. Y.

The assembly comprises a pair of wire inner conductors with a tubular jacket enclosing them and spaced from them and die cast insulators on the inner conductors spaced longitudinally thereof and adapted to position the conductors within the tubular jacket, the insulators comprising discs arranged at an inclination to the conductors, each disc being parallel to adjacent discs, the extremity of each disc at one inner side of the tubular jacket being in overlapping relation to the other extremity of an adjacent disc at the opposite inner side of the tubular jacket.

* * *

NO. 2,453,313, METHOD OF MANUFACTURING COMMUNICATION CABLES, patented November 9, 1948 by Chester S. Gordon, Boonton, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N.Y., a corporation of New York.

In this method, there is applied, directly about a pair of wire conductors encased in a common insulating body, a conducting layer of high conductivity metal for stabilization of the electrical properties of the insulated conductors, then the conducting layer is sectionized to increase its over-all resistance for localization in the lengthwise direction of the affect of an applied test voltage, whereupon there is applied the test voltage between the conductors and the successive portions of the conducting layer for breakdown of any fault in the insulation of the insulated conductors within the localized lengths of the cable, and finally there is applied an outer protecting layer about the conducting layer.

* * *

NO. 2,453,337, WIRE STITCHING FEED, patented November 9, 1948 by Joseph N. Pagliarul, Milwaukee, Wis., Enez Pagliarul Kowalsky (Enez Kowalsky), executrix of Joseph N. Pagliarul, deceased, assignor to Inland Wire Products Company, Chicago, Ill., a corporation of Illinois.

This is an apparatus for intermittently feeding wire, and includes a feed segment pivotally mounted adjacent the periphery of one of two feed rollers having an outwardly projecting gripping portion and an inwardly offset portion which limits the length of feed of the wire, a rotatively adjustable gage disc mounted on the other roller, a feed segment integral with this disc and extending adjacent a peripheral portion of its roller, an adjusting device carried by the first-mentioned roller and contacting the pivotally mounted feed segment for limiting the yielding pivotal movement of the feed segment.

* * *

NO. 2,453,418, BUOYANT ELECTRIC CABLE, patented November 9, 1948 by Percy Dunsheath, Abinger and William Cyril Barry, Gravesend, England, assignors to W. T. Henley's Telegraph Works, Company, Limited, Wescott, Dorking, Surrey, England.

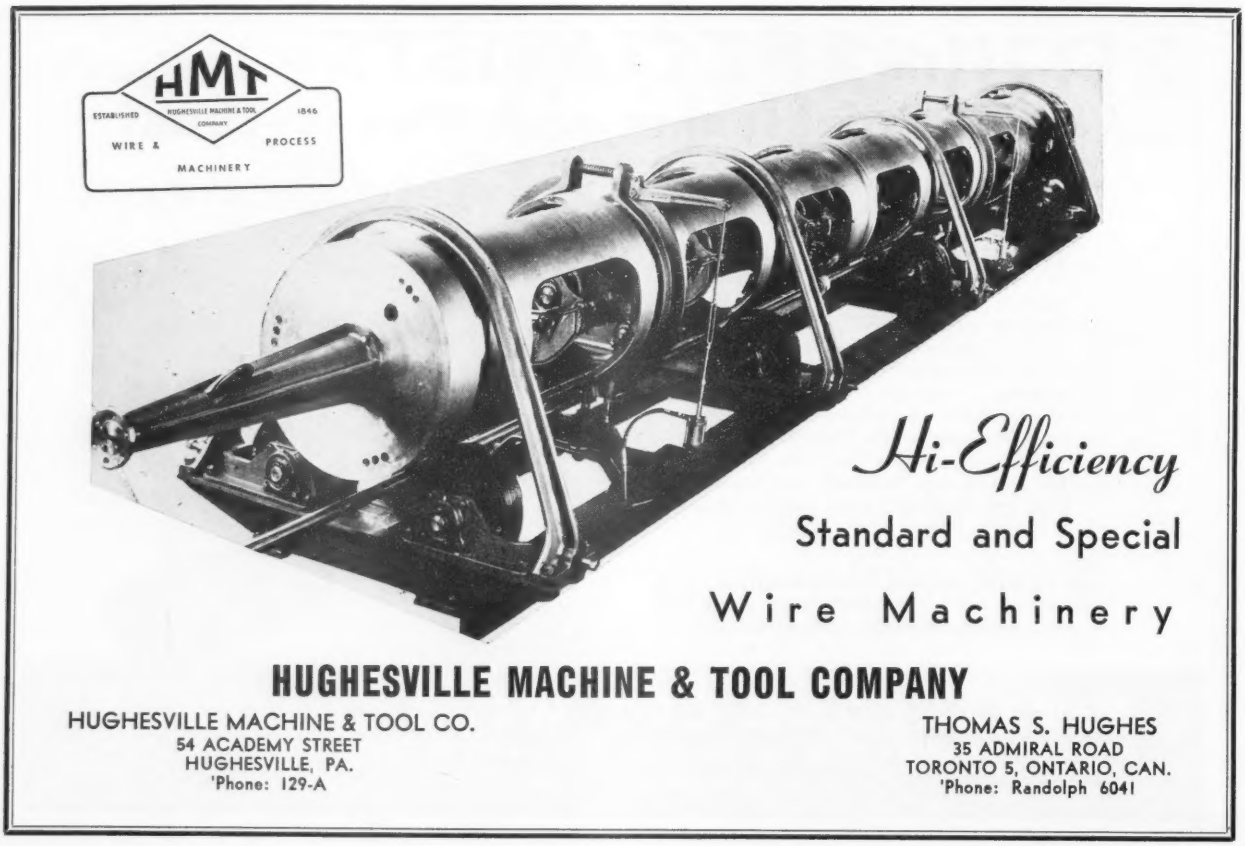
A buoyancy agent is employed, consisting of a flexible cellular core comprising a series of resilient members with intercalations of relatively rigid members.

* * *

NO. 2,453,419, BUOYANT ELECTRIC CABLE, patented November 9, 1948 by Percy Dunsheath, Abinger and William Cyril Barry, Gravesend, England, assignors to W. T. Henley's Telegraph Works Company, Limited, London, England, a British company.

Here the buoyancy agent consists of a flexible cellular core comprising a series of cylinders of resilient cellular material and a number of cylinders of

Complete Description and Drawings of Patents May Be Had for 50 cents, outside the United States and Canada $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.



relatively rigid material intercalated in the series of cylinders.

★ ★ ★

NO. 2,453,420, BUOYANT ELECTRIC CABLE, patented November 9, 1948 by Percy Dunsheath, Abinger, and William Cyril Barry, Gravesend, England, assigners to W. T. Henley's Telegraph Works Company Limited, London, England, a British company.

About the flexible core member is a buoyancy element comprising a series of resilient members with relatively rigid members intercalated in this series of resilient members.

★ ★ ★

NO. 2,453,749, COIL-WINDING MACHINE, patented November 16, 1948 by Harry A. Hilsinger, Jr., East Orange, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

This machine is adapted for winding rectangularly shaped coils two opposite sides of which are curved and the other sides straight.

★ ★ ★

NO. 2,453,840, INSERT COIL SETTING TOOL, patented November 16, 1948 by Kenneth B. Geertsema, Valley Stream, N. Y., assigner to Heli-Coil Corporation, a corporation of New York.

The tool is provided for setting an insert coil in the threading of a tapped hole.

★ ★ ★

NO. 2,454,010, WIRE CORE EXTRACTING MACHINE, patented November 16, 1948 by Enrique Sauto y Hurtado de Saracho, Mexico City, Mexico.

More specifically, this machine is intended for the extraction of ring-like wire cores from their surrounding bodies.

★ ★ ★

NO. 2,454,011, SPARK TESTING APPARATUS FOR INSULATED ELECTRIC CABLES AND WIRE, patented November 16, 1948 by John Henry Savage, Yelling, England, assignor to W. T. Henley's Telegraph Works Company Limited, Dorking, England, a British company.

An electrode is provided comprising a series of electrically inner-connected chains forming a flexible curtain surrounding and conforming to the shape of a cable in position for testing, these chains extending transversely of the direction of run of the cable along the axis of the electrode and being set in sequence along this direction forming a conductor distributed around the axis.

★ ★ ★

NO. 2,454,220, MATTRESS, patented November 16, 1948, by Maurice D. Seeche, Lawrence, Mass.

While the mattress employs wire coil springs, the invention resides in the upper and lower pads associated with the springs.

★ ★ ★

NO. 2,454,241, WIRE-CUTTING APPARATUS, patented November 16, 1948 by August Wennerberg, Chicago, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

Feed rollers force the wire into position over a cutting edge formed of a pivoted member that is resiliently urged toward the path of a cutting blade mounted upon a flywheel rotating in timed relation to the feed rollers.

★ ★ ★

NO. 2,454,625, INSULATED ELECTRICAL CONDUCTOR AND METHOD OF FABRICATING THE SAME, patented November 23, 1948 by Lewis A. Bondon, Arlington, N. J.

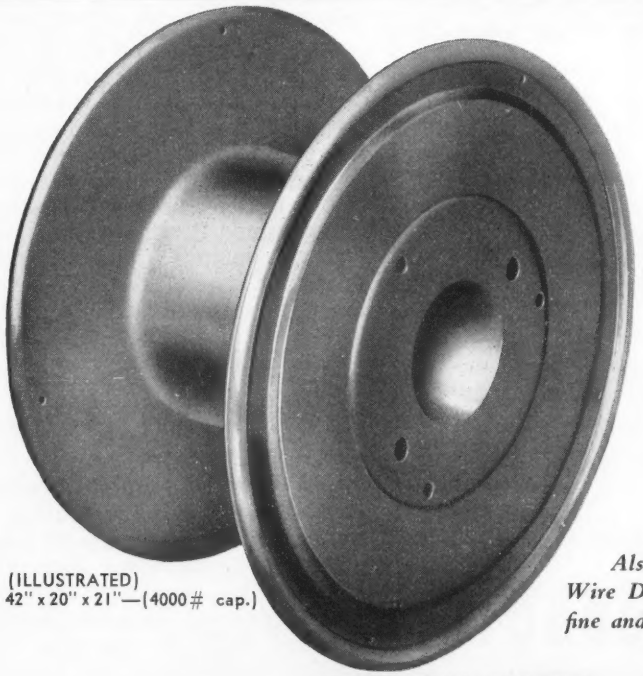
About the wire conductor is a surrounding layer of laminated polytetrafluoroethylene having a film of dielectric lubricant interposed between the contacting surfaces of the laminated polytetrafluoroethylene.

★ ★ ★

NO. 2,454,800, INSULATED ELECTRIC CABLE AND INSULATION THEREFOR, patented November 30, 1948 by Sidney R. Hartstein, New Brunswick, N. J., and Fred Stolte, St. Albans, N. Y., assignors to Federal Telephone and Radio Corporation, New York, N. Y., a corporation of Delaware.

In this patent, the wire conductor is surrounded by finely divided air-retaining diatomaceous silica incorporated in a binder of strong and flexible insulating material.

(*Please turn to page* 102)



(ILLUSTRATED)
42" x 20" x 21"—(4000# cap.)

HEAVY DUTY

BREAK-DOWN REELS

1000#
2000#
4000#
} capacities

Rugged Design including patented DURA-CURL rim, and many other features necessary to provide the *Strength* and *Durability* needed for continued successful performance.

• • •

Also complete line of sizes of Modern High Speed Wire Drawing NO-CREV Spools and Reels for both fine and intermediate size wire.

MOSSBERG PRESSED STEEL CORP.

18 WEST STREET ATTLEBORO, MASSACHUSETTS, U.S.A. Telephone Attleboro 847 & 848

Fiberglas Clinic

MORE than 60 representatives of electrical rewind and repair shops throughout the United States attended the clinic sponsored by the electrical division of **Owens-Corning Fiberglas Corporation** in connection with its approved service shop program.

* * *

THE clinic was held in Toledo, October 28 and 29, and was the first of the annual and semi-annual meetings that will be held to keep approved service shop representatives fully informed on new products and shop practices related to the use of Fiberglas-base insulation materials.

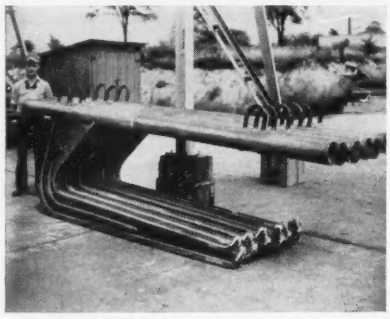
* * *

GUEST speakers at the Toledo clinic included Harry Meyer, manager of maintenance sales, Westinghouse Electrical Corporation; David K. Peck, electrical engineer, National Electric Coil Company; and B. F. McNamara, Insulation Manufacturers' Corporation.

* * *

Welded Pickling Hook for Heavy Duty

THESE six hairpin pickling hooks, weighing 1272 pounds each, are capable of carrying loads up to 4200 pounds. Fabricated



Welded Pickling Hook

entirely by welding, the hooks themselves are made of heavy Monel plate. The round supporting members are of steel covered with a welded-on jacket of 14 gauge Monel. The hooks were designed and made by **Youngstown Welding and Engineering Company**, Youngstown, Ohio, for the pickling of wire and cable.

* * *

Combination Oil-Gas Burner Described in New Catalog

DESIGNED to meet the winter gas shortage problem in many industrial areas, the **Hank Manufacturing Company**, 124 W. Tenth Street, Brooklyn, 15, N. Y., offers a new combination oil and gas industrial burner that permits instant switch-over from one fuel to another. It is described in a new 8 page catalog and is said not only to permit alternate use of whatever fuel is available but its automatic proportioning valves provide maximum burning efficiency for either type of fuel. Copies of the catalog No. 408 will be mailed free of charge to interested parties by the manufacturer.

* * *

New Firth-Sterling Catalog on Tools

JUST published by **Firth Sterling Steel & Carbide Corporation** of McKeesport, Pa.—a new 28 page Bulletin FE-127 which lists and describes this company's standard line of sintered tungsten carbide tips and tools, boring bits, Mechanigript adjustable tool holders; also special tips, nibs and wear parts made to customer's specifications. Available to anyone writing on company letterhead.

* * *

MAKE USE OF . . . .

WIRE & WIRE PRODUCTS

in your ADVERTISING plans.

Many of the outstanding suppliers of rods and wire, and most of the manufacturers of machinery, equipment and supplies used in wire mills and wire product fabricating plants are now availing themselves of WIRE AND WIRE PRODUCTS' unique, concentrated circulation in our industry.

If you are producing equipment or supplies for the industry, join this "blue book" of concerns—our present advertisers—and extend your contacts, back up your salesmen and direct mail promotion, so that you, too, may become an integral part of the field.

Place yourself in a position where you can be "on the inside looking out" rather than on the outside hopefully looking in.

Hundreds of reports indicate that advertising in WIRE AND WIRE PRODUCTS is resultful. We offer any reputable firm an opportunity to avail itself of the fertile field of sales available through our advertising pages.

For rates and other data, write to

WIRE and WIRE PRODUCTS

Edmund D. Sickels, Advertising Manager

300 MAIN STREET STAMFORD, CONN.

Holden Liquid Electrode Furnace

A FOLDER on the Holden Type 601 Liquid Electrode Furnace, which was announced and exhibited at the Metal Show in Chicago in 1947, has been released by **The A. F. Holden Company,** New Haven 8, Conn.

★ ★ ★

THIS folder is the first brochure published on this unit, and the technical data in the folder was held up until a sufficient number of these units had been installed in the field for test for actual operation under production conditions.

★ ★ ★

THERE are several factors about this unit which are worth considering:

(1) The economy of this furnace lies in the fact that the power conductors that transfer current to the pools which hold the liquid alloy are entirely surrounded by refractory. This permits the reduction in surface radiation area by 25%, and, therefore, lowers the cost of operation as a direct radiation factor.

(2) The assembly bringing the power to the pools being entirely enclosed in the wall except for the terminal connection to the transformer, reduces radiation losses, versus the old type electrode assembly, by approximately 10% in power savings.

★ ★ ★

INASMUCH as the entire assembly is surrounded by refractory, the life of the pool as well as the life of the carrying power conductor bars is materially enhanced, since they are sealed from air and salt circulation.

★ ★ ★

OF particular interest is the adaptation of a starting coil which permits this unit to be started on an electric resistance circuit and therefore this unit may be shut down for power failures by simply installing a resistance coil.

★ ★ ★

THE overall savings in operation on such a unit lie in the reduction of radiation losses and the elimination of expensive over-the-side electrode replacements.

★ ★ ★

PLEASE address the Company if you would like to have the folder.

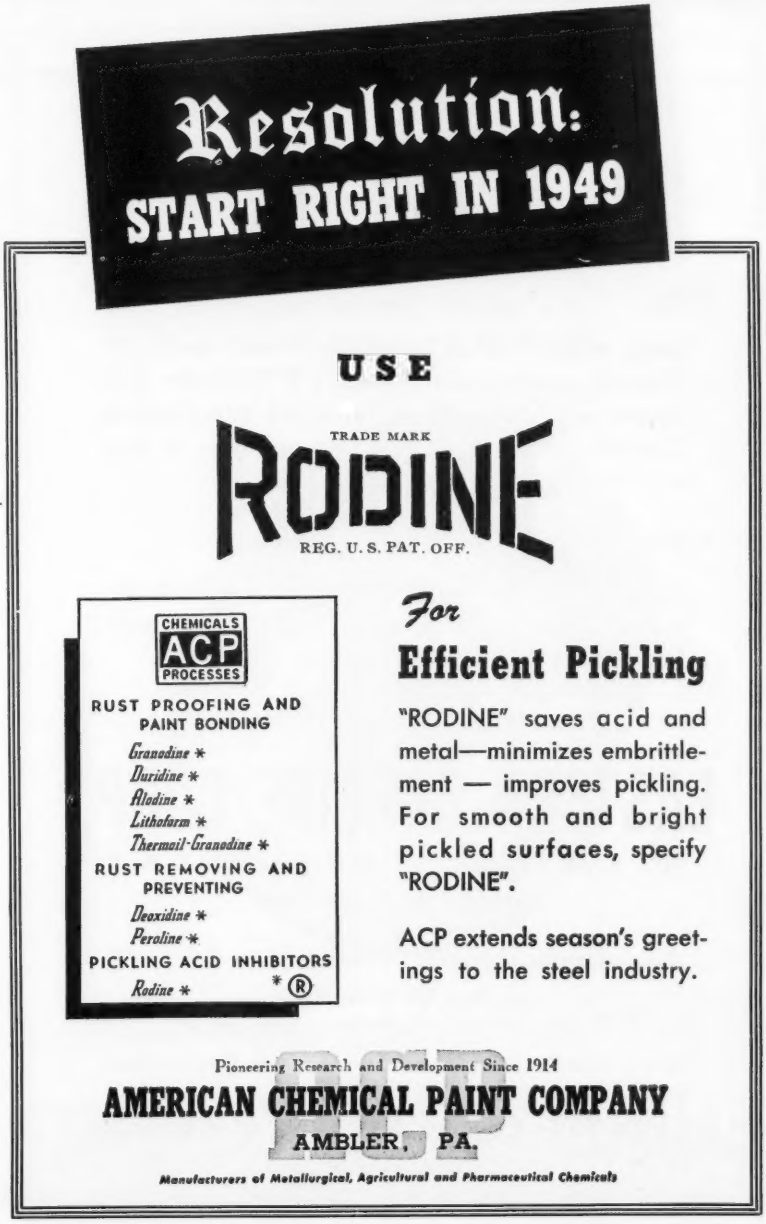
★ ★ ★

Wire Association Proceedings Monday, October 18, 1948 Session

(*Continued from Page* 51)

"Practical Applications and Practices with Carbide Dies."

do not make cored back reliefs, and that has been until recently in the hands of the die makers there is no novelty there; even though we could claim some credit for having introduced it, we think all we did was to take the labor out of the die room and put it in our plant, and we calculated the back relief so that at each enlarging of the hole size the relative position with respect to the center of the die would be maintained. That is what you have done and shown up there. The longer you have that piece of carbide and the bell mouth at the top (it being the weakest part of that die) the more there is a tendency, to break the die before it even reaches the die room. There is a compromise and there must be a compromise which will not increase the breakage again. I reiterate, don't let anybody go away from this place thinking he is going to have perfect dies. He will get his fingers burned



badly. In our attempt to reduce costs, we think it is incumbent upon us not just to make a better looking die with a lot of eye appeal. When we sell them a product they must know they are not going to have an attendant weakness which might destroy the thing we sought to achieve. From our standpoint, when one of our men calls on the die man he would say "You heard about that new high nib? That is the one we want," and the next thing he will say is, "The darned thing is no good." We have got to balance it.

Mr. Miller: I believe you are crying before you are hurt in that case. We have tested these dies and haven't broken any of them yet. We have tested them under different conditions, such as they will be used under in the wire mill, and frankly, in my experience with carbide dies, I haven't found very many of them breaking up around the bell. Most of them break in the reduction angle. We have never had a great deal of trouble with our dies breaking.

A Member: May I ask why they reduced the height of the nib in the shape die industry?

Mr. Miller: May I ask why, because I don't know.

A Member: For the same reason I advocate caution on raising the height, because it makes a strong die. Since all dies break, anything that you do in the direction—

Mr. Miller: (Interposing) When you say "all dies break," do you mean a percentage of all dies break?

A Member: All dies break.

Mr. Miller: I don't believe we will agree with you on that, as a group of wire mill men. I have spent a lot of time in wire mills. We have thrown kegs and kegs and kegs of dies away, and stored them away somewhere, not because they broke, but because they weren't high enough so that we could use them any longer, and I think you will find that is a condition in every wire mill.

A Member: I think another thing hasn't been touched on, and that is the hardness of the die. It has a lot to do with it, whether it has thirteen per cent cobalt or sixteen per cent cobalt. We watch that rather closely and usually take a rather softer die, even for the hardest steel wire, I imagine the copper people can take a harder die.

A Member: May I use the blackboard?

Mr. Miller: Certainly.

A Member: The extension of the idea to where it is absurd tends to prove our point. Mr. Miller said that the die wasn't any good because it wasn't high enough. Let's take that kind of a die. Now, if we wanted to open it up, what good does it do whether this is high or not, it still runs out. Mr. Miller said that if you made it high enough it would be better. All right. We will take that thing and make it high enough. Now, we will put it that way, if that is the way you want the die. Suppose I were to open it up to here—

A Member: That is exaggerated now. That is not what we had on the board.

A Member: What good does it do—

A Member: (Interposing) You still have a straight hole.

A Member: Mr. Miller said if you made it high you would have more metal. I say it wouldn't do you any good because you would probably want to cut back in here in order to save labor. Somewhere in between there is a compromise. I think Mr. Miller is correct in saying that something should be added. All I am emphasizing is not to go hog wild on length, because the minute you do your breakage is going to mount.

Now, this nib business—everybody has what is known as an accumulation point in dies, except those manufacturers who buy their dies for one inch, one and a quarter. In their case, they buy the dies for a specific size, but the case of all dies in the wire industry is that you buy the original die—the first die—because when that goes out you have to replace it, and so back along the line you get the funnel of dies like that. You start with dies here, let's say. You are using five machines and up there you are using one machine. Somewhere in between you get an accumulation of dies. In our industry we have racked our brains to see how to better serve you. The old dies, which had better usage and lower cost, made less investment, so you could throw them away. We could do that up along the line, but as you break down from the rod you have got to have a die which will give you what you require and give you low cost. Unfortunately, you can't do that. You have to make somewhat of a compromise. Ten years ago, all dies were in the R-5 class. You now use between R-4 and R-3 to do the job. In this one you come to a little more trouble, because you have other operating condi-

YOUR COMPLETE CARBIDE
REQUIREMENTS
FROM **ONE** SOURCE

DIES

Large stock of rough cored dies. Rough and Semi-finished mandrel nibs, Heading & Extrusion dies, Knives and Quills, Wear Parts and miscellaneous Carbide items can be furnished promptly to your specifications.

TOOLS

Large representative stock of WENDT-SONIS carbide cutting tools including single point tools, Reamers, Drills, Counterbores, etc.

Quotations Furnished on Request

EASTERN CARBIDE CORP.

909 MAIN STREET NEW ROCHELLE, N. Y.

Telephone: New Rochelle 2-6630

Representatives of Hyprez Diamond Lapping Compounds for Your Die Room Needs.

Eastern Distributors of Wendt-Sonis Carbide Cutting Tools.

COMPLETE CARBIDE SALES & SERVICE

tions, which increase your cost. There is nothing sacred about these sizes from the standpoint of must you buy an R-3. In the industry ten years ago an R-5 was then 625 by 625. That was the standard. Now what is happening here—what is the height of the R-4?

Mr. Miller: .500″

A Member: And the diameter?

Mr. Miller: .550″

A Member: Ten years ago, you took this one which was 625 by 625. If you didn't like that, you made it this way. Now, I say you are doing the same thing. You are going back to what you said you didn't like ten years ago.

Mr. Miller: But I said if the die wasn't high enough. I didn't mean you could go up to here. I meant it wasn't high enough to use the diameter you are supplying. We don't want to throw that diameter away. Add enough height on to the diameter so you use both the diameter and the height.

A Member: We can do that without altering the die. If you go back to the R-5, which was 625 by 625, you have changed that and now you are coming back to the same thing.

A Member: Is that die used for steel or copper?

A Member: That is used interchangeably.

A Member: For copper it is shaped differently and won't break up.

A Member: Nobody breaks copper dies. They do in the steel business.

A Member: There should be a happy medium. They should be specified whether they are for copper or steel.

A Member: I think they would be different in metallic content rather than in shape.

A Member: When people come to me to sell dies, I ask them if a particular die is recommended for steel or copper. They don't know. They say, "All the dies we make are made for steel." No one yet has said they have a certain die for copper. They don't know.

A Member: That astounds me, because I don't think there is a die maker in the room who feels that way about it. Dick Bronson, do you call on this man? If you called on this man, would you say you used the same shape for copper you use for steel?

A Member: No.

A Member: When you call on a man drawing copper, would you say he would have the same for copper as for steel?

A Member: The harder carbide you get into it, the better steel wire you are going to draw, and the softer the carbide, the better copper you are going to draw. We have made tests. We have drawn copper with no binder at all, and then we went up to H13 and H15 and our die life increased.

A Member: I won't agree with that, but if you found it that way—

A Member: (Interposing) I have been making diamond dies in wire drawing for the last twenty years, and there is nobody yet that has any set standard for copper. They will always say it is for steel wire.

A Member: I don't agree with you. We made a job for copper, and one for steel.

Mr. Reeder: I am sorry, gentlemen. I am afraid we are going to have to continue with the next paper. I am sorry to break up this interesting discussion. Perhaps it can be settled after the meeting. Without waiting any further, I think we better go ahead with this third paper. The subject is "Fumes and Ventilation in the Wire Mill" by Wallace G. Imhoff, President of the Wallace G. Imhoff Company, Los Angeles, California.

"Fumes and Ventilation in the Wire Mill."

(*Continued from Page 54*)

us smelled combustion fumes and we, of course, thought that was very odd. What had actually happened was that they got the two things mixed, fumes and ventilation. Getting rid of fumes is not ventilation, and ventilation isn't heating. In other words, each one is a separate problem. Ventilation is one problem; heating is another; getting rid of fumes is another. You may have pickle fumes where you need inhibitors. One of the most important things in regard to pickle fumes is to see that there is enough pickle capacity. I guess some of you men are familiar with the old type pickle vats where you ran them up to a hundred and eighty or two hundred degrees, and the fumes went all through the room. You must have a large pickle capacity. You must use a foam blanket and inhibitors.

A Member: There is a new development to reduce fumes and set up atmospheres. I understand that is going to do away with inhibitors. It is a new machine to produce ozone. Those machines can be bought for five hundred dollars apiece, and they are very efficient.

Mr. Imhoff: That is something very interesting. I hadn't heard about that.

All Metal

WIRE SPOOLS

Light weight, all-steel, lithographed.
5", 6½", and 10½" diameter ends.
Ends and traverses may be shipped unassembled.

We also produce spools for fine and magnet wire.

J. L. CLARK MANUFACTURING CO.
600 23rd AVENUE • ROCKFORD, ILLINOIS

I am very glad to have that information.

A Member: In the steel industry there has been as much thought given to the elimination of acids as there has been to ventilation. In other words, why not go back to the source and find some way to clean them.

Mr. Imhoff: You mean, without acids?

A Member: Yes. You don't need acids if you get the steel clean, is that correct? There has been some progress made but I don't think the engineering effort has been put forth for the elimination of acids, especially sulphuric. I believe that is the place where it should be started, right at the source; to eliminate pickle rooms would be a good start. It would be a Godsend to all plants.

Mr. Imhoff: I tried to follow that along. In fact, during the war, when I was sent around by the Government to take care of a lot of various things in pickling, galvanizing, and so on, I remember speaking—in Philadelphia in 1942 I think it was—with a very prominent engineer, and he told me that after the war there wouldn't be any pickling. They had already developed the elimination of pickling by reduction and enclosed atmosphere. I told him that when a person works from just one angle you naturally see just the one viewpoint. I happened to be associated with every angle. One day I might be in a wire mill, the next day I might be in a forge plant, where they make pole-line hardware. The one thing you have to remember when you are pickling is the fact that every bit of energy that is used in forging that steel, all the heat that goes into it—when a scale is formed on the outside of a heavy forging, and before that scale can be removed—that energy has to be released. In annealing in a sheet furnace or where you have these controlled atmospheres, it is very easy to remove that scale with weak acids, but I don't know of any atmosphere that could remove a great, big, heavy blue forging scale. That takes a ten to fourteen per cent acid and 160 to 180 degrees temperature.

A Member: In your wire industry, with cold drawn bars, there is more of that soft scale than there is of forging scale of the type you are speaking of. There has been some development along that line up in South Bend—on bars. I understand that they are now working on a machine for cleaning coils. I don't know how far along they are, but that is a long way off. I believe if the effort was put forth, we could find some way to reduce our pickling. I think the industry is taking this lying down. Back in 1933 there were very few mills operating in Pittsburgh, but we had a lot of smoke just the same. It also comes from homes, but industry takes the blame for all of it. It is time industry took a stand on it. I believe if the effort was put forth there would be some way found to eliminate acid to a certain extent in wire drawing. I don't how to do it; otherwise, I would gladly tell you. It has always been accepted we must have it.

Mr. Imhoff: That is true. There are a lot of problems like that. I have certainly done some very, very lively thinking on that myself. For instance, speaking of the fume end of it anyhow, I spent all my life in the galvanizing industry and I have never yet been able to find out how to eliminate the fumes from "dusting on." You know what that is—the white fumes from sal ammoniac when you "dust it on." You don't have it so much in the wire mill but in galvanizing you have it. For thirty-odd years we have been trying to see if we couldn't find some other materials, to eliminate those fumes, but we haven't been able to do it. When the liquid flux came along, that eliminated fifty per cent of the fumes formerly made, because the material formerly used for galvanizing was practically one hundred per cent ammonium chloride, which was all fumes. Now we have an application that will use only forty-five per cent of the fume-making material and fifty-five per cent is zinc chloride. That is a big saving in fumes. From the standpoint of pickling, I think the most important thing in my twenty-five or thirty years of experience in pickling has been that fume making is connected with tank capacity. I have gone into so many plants and found they didn't have enough tank capacity. If they don't have enough tank capacity to take care of their production, they naturally must carry the acids stronger and the temperature higher. That makes more fumes. Now we have the enclosed steam coils which have been in since 1933. You remember before that time open steam outlets ran it down in the pickling tank, and both the steam and acid fumes came out into the air.

A Member: We have attempted to ventilate some of our pickling rooms. We

AUTOMATIC
STRAIGHTENING AND CUTTING
MACHINERY
equipped with
FLYING SHEAR
for
ALL KINDS OF MATERIAL

THE HALLDEN MACHINE CO.
THOMASTON, CONNECTICUT

have, at our enameling plant in Canada, a pickling room system which takes the fumes off the top, washes the air across, and takes it away.

Mr. Imhoff: You mean a down draft? Sucking the air off the top and down?

A Member: Yes. We painted that pickling room white in January, 1943, and last year we repainted it, but not on account of the entire thing being dirty. There are no fumes that come up out of the trenches, or the walls. It worked out very well, but the point is to eliminate fumes altogether if you can.

A Member: I think it is a matter of cost. You can get away from acid if you want. It is a matter of cost.

Mr. Imhoff: That is right. On the other hand, I don't know just how strict they are here in Pittsburgh. I lived in Pittsburgh years ago, but when I got to Los Angeles, I found out they have very, very strict ordinances against both fumes and dumping acid in the sewers. I made some tests this year in a large range boiler and tank company. Before you can dump any acids in the sewer, it must test pH five. We had a ten thousand gallon tank, and when we finally got that solution down so it would show a test of pH five, we figured we had diluted the waste pickle to over a million gallons—we would have to dilute that one ten thousand gallon tank with a million gallons of water to get it down to meet the required city ordinance. That immediately threw that out, and now a good many companies are using sodium-hydrogen-carbonate and that is the end of it, because that gives you a harmless sodium soluble solution you can run right into the sewer.

A Member: I was interested in a recent remark regarding exhaust fumes. On Page 899, the figures are rather optimistic in that the arrows all point in one direction, toward the spot that sucks the gas away. You can blow it a distance. You can't suck it at a distance. Suction is purely local and comes in all directions more or less equally. I think a remark there was that a jet was blowing from the front towards the back.

A Member: In our pickling room it is blown across the entire length of the room, and also taken out.

A Member: That is a positive scattering effect.

Mr. Reeder: Any other questions for discussion? This concludes our meeting for this afternoon. I wish to thank you very much for the paper, Mr. Imhoff, and if there are no other items to be brought up before the meeting, we will consider it adjourned.

(Whereupon, at 5:00 P. M., Monday, October 18, 1948, the meeting was adjourned.)

Tuesday, October 19, 1948 Sessions

(*Continued from Page 55*)

"Control and Production of High Carbon Wire."

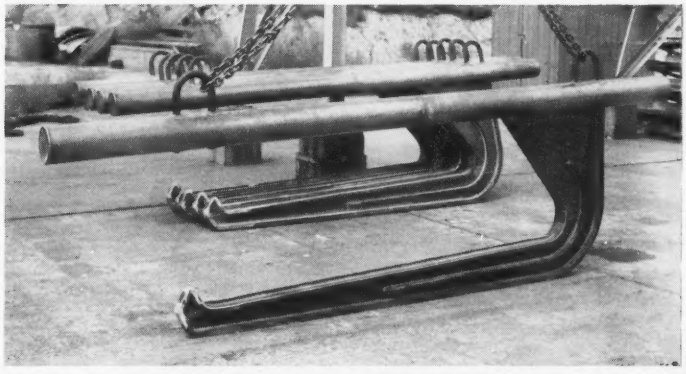
ularly for us. We do quite a bit of air patenting. It gives you a steel that quenches in air a little bit more readily, so we feel, it is pretty good. Recently we have had several heats exceptionally high in alloys. So far as charts and methods of figuring are concerned, that was way off, so we had to make a special pilot run on those. Sometimes we got in the middle of them before we discovered we should have started with a pilot test, but that is the only thing you can do, and I might say we have got several of them lately because of the type of scrap we are using. Often your residual alloys will run up and cost you something, but as I said in the beginning, these charts are the result of a great many tests that were run—pilot tests—so those were figured in as we went along. When you wanted to start from scratch you would have to consider all the elements. We took care of that in allowing a forty thousand pound constant for iron. Actually, iron wouldn't run quite that high.

A Member: Does it do any good to draw that imperfect section back into the heated area when you start up?

Mr. Weiss: Yes. It will correct the condition. I am glad you asked that. I should have mentioned it—pulling it back into the furnace and heating it. That section is only a very short section—I would say six inches. I think it is less than that, actually.

A Member: When you are patenting from nine gauge down to sixteen, I presume you have a stock of gauge sizes to follow. That is, you start at nine and then go to ten or eleven. How do you change over your gauge sizes?

Hairpins THAT LIFT TWO TONS



WELDCO lightweight **hairpin hooks cut pickling costs . . . resist corrosion . . . last longer**

These hairpin pickling hooks, recently shipped to a leading Eastern wire mill, measure 14 feet in length, and each can handle 4200 pounds of coiled steel products at a time. Lightweight and unusually strong, the Weldco hooks are made of heavy, corrosion-resistant Monel plate. The spreader bars are of steel tubing, Monel-sheathed for maximum protection against strong pickling acids and fumes, and to keep scale or rust from falling onto the coil being processed.

Many wire mills throughout the country use Weldco hairpin hooks because of their excellent service record. Why not find out how these new, improved high-strength hooks can cut your costs? A phone call or letter will bring you complete information.

THE YOUNGSTOWN WELDING & ENGINEERING COMPANY

3706 OAKWOOD AVE. . . . . YOUNGSTOWN, OHIO

Do you run up on every gauge size or do you couple nine and ten together, ten and eleven together, or what do you do?

Mr. Weiss: We would run nine and ten together at the same speed, because the difference in size wouldn't be great enough to affect the end result. However, in our take up equipment we have several forty wire units that are run by five different motors. There are eight blocks on each motor so we can run each of them at different speeds. We can run five different sizes on each furnace and maintain a constant load. We might have sixteen gauge running on the one take up unit, fifteen or sixteen revolutions per minute. You may have nine gauge on another unit running at six revolutions per minute. That is what we think is one of the advantages over electric patenting. You can't do that with electric patenting because in electric patenting if you run two widely different sizes you would have to set up for one size or the other. You would have to set up a voltage for one size. For the heavy wire, you would have to run your fine wire so slow it would be economically unsound. If you set it up with a fine wire, you would have higher voltage. You would have to run heavy wire so fast a man couldn't stand it—couldn't handle it. I'm not picking on you, Joe. I am just trying to point out the conditions we have in our plant.

A Member: It is very evident on these large sizes that you must have some means of force cooling. Does that give you uniformity across your furnace and at what gauge do you start in forced cooling?

Mr. Weiss: On 343 rods and larger, we do. We have forced air cooling. We don't do any quenching, and we have one take up unit. Air blows over the surface. That is all of the forced cooling we have. That is what you meant?

A Member: That is right. Do you get the uniformity on every strand?

Mr. Weiss: Well, I wouldn't say we get one hundred percent uniformity, but for all practical purposes we get uniformity. Did you think there would be some non-uniformity?

A Member: I thought your center wires wouldn't cool as fast as your outer wires, even with the fan.

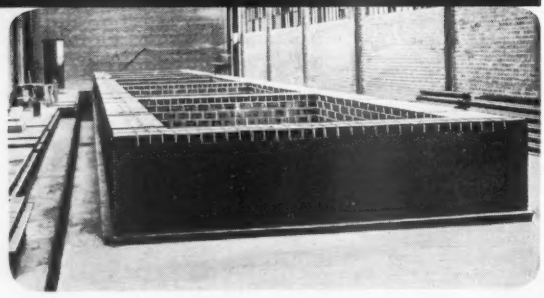
Mr. Weiss: We hadn't noticed that.

Mr. Findley: That is about all the time we have. Dr. Zapffe and Miss Haslem have prepared a very interesting paper on what is probably a somewhat controversial subject. In other words, "The Evaluation of Pickling Inhibitors from the Standpoint of Hydrogen Embrittlement." Dr. Zapffe is now a consultant in Baltimore, and Miss Haslem is a research chemist in his laboratory. I believe Dr. Zapffe will present the paper.

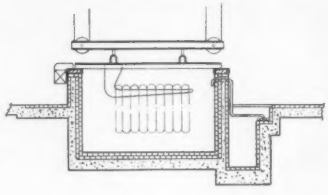
PRODUCTION HOLD-UPS

due to corrosion caused "down time"

CAN NOW BE DONE AWAY WITH



COMPLETE
SEVEN UNIT BATTERY
of WIRE PICKLING TANKS
Atlas Dual Construction
Concrete, lined with 8" of acid-proof brick laid with Tegul-VITROBOND and Carbo-KOREZ cements. This set-up is 94'10" long and includes acid dip (3 tanks), rinse (1), bright dip (2), and tallow dip (1)



WITH tanks, floors and other acid-handling units of Atlas construction, you'll have no more unwelcome delays while corrosion damage is being repaired • Atlas construction is *completely proof* against — not merely "resistant to" specified acids, alkalis and solutions of any predetermined concentration and temperature • Atlas patented DUAL CONSTRUCTION permits high temperature pickling. Construction costs are lowered, units can be put into service days sooner — and solutions can be handled at up to boiling point • Atlas construction, using acid-proof brick, cements and coatings, is super-resistant to mechanical punishment. It serves in the largest steel and chemical plants year after year, without maintenance expense or time out for repair • This construction is used also in sumps, sewers, pits, stacks and neutralizers • Contact our representative at nearest listed branch — and write us here at Mertztown for Technical Bulletin M2-1

THE Atlas Mineral Products Company of Penna.

THE ATLAS MINERAL PRODUCTS CO. OF TEXAS INC., Box 252, Houston 1, Tex.

•BERKELEY 2, Calif., 605 Addison St.
DALLAS 5, Tex., 3921 Purdue St.
•DENVER 2, Colo., 1921 Blake St.
•HONOLULU 2, Hawaii, U. S. A.
OMAHA, Neb., 423 South 38th Ave.
•LOS ANGELES 12, Cal., 172 S. Central Ave.
•SEATTLE 4, Wash., 1252 First Avenue, S.
*Stock carried at these points

MERTZTOWN
•ATLANTA 3, Ga., 452 Spring St., N. W.
•CHICAGO 1, Ill., 333 No. Michigan Ave.
•DETROIT 2, Mich., 2970 W. Grand Blvd.
NEW YORK 16, N. Y., 280 Madison Ave.

PENNSYLVANIA
PITTSBURGH 27, Pa., 4921 Plymouth Rd.
PHILADELPHIA, Pa., 355 Fairview Rd. Springfield, Pa.
ST. LOUIS 5, Mo., 7603 Forsythe Blvd.

IN CANADA: Atlas Products are manufactured by H. L. BLACHFORD, Limited, 977 Aqueduct Street, Montreal 3, P. Q., 86 Bloor St. W., Toronto, Ont.

"Evaluation of Pickling Inhibitors from the Standpoint of Hydrogen Embrittlement."

(*Continued from page 56*)

1200°F, the gas becomes soluble again in the walls of the "pocket," and you begin to defeat your purpose. Don't go much above 1100°F if you want to get rid of hydrogen embrittlement, because you will just put the gas back into the steel, and on cooling it precipitates back into the little slip-plane "pockets" and sets up embrittlement all over again. As for the time at temperature, this depends a great deal on the size of your specimen, increasing roughly as the square of the thickness.

A Member: Did you, in any of your experiments, try comparing sulphuric acid with hydrochloric?

Dr. Zapffe: Yes, we did, and the two acids are virtually identical in their effect. We also tried cathodic treatment in 10% H_2SO_4, in 10% HCL, and in 10% NaOH, and the embrittlement again is exactly the same. We surveyed most of the common acids. In acids of equal pH, embrittlement is generally equivalent. Thus, (even acetic and phosphoric acids can render as much injury as H_2SO_4, and HCL, and must be watched.

A Member: Have you studied the effect of time after pickling on the embrittlement?

Dr. Zapffe: On recovery, you mean?

A Member: Supposing you make your test within a day after you have done your pickling and then take the same test a month later, or two months later—do you get the same result?

Dr. Zapffe: We have studied this quite carefully, and part of your question has perhaps just been answered. With electroplating, however, we have found some interesting things. There is also an anomaly in straight pickling. If you examine a specimen for brittleness immediately after pickling, you get a given angle of bend—say, a hundred degrees—but if you let it sit there a few minutes first and then measure it, it may break off at fifty degrees. Still later, it will return to 100 degrees, and later to 180 degrees. We call that anomaly an

"aging minimum"—whereby a steel with a given degree of brittleness after pickling becomes more brittle first and then ages back. We account for it on the basis of the description of gas behavior just given you, and it accounts for many curious shop experiences of cracking "on the shelf." Thus, during pickling the hydrogen atoms diffuse into the iron lattice and proceed to precipitate into the slip-plane "pockets." For some period after pickling, this relatively deliberate process will continue, causing increased embrittlement after pickling. With electroplating, hydrogen atoms diffuse into the basis metal, and later into the plate forming on it. Then, during aging, the gas may diffuse from the basis metal into the plate, making one ductile and the other brittle, or vice versa, providing several strange results. It is an extremely interesting situation, and, though complicated, can be explained on the basis of the general theory.

A Member: Have you found any impurities in commercial sulphuric that affect the **result?**

Dr. Zapffe: Not so far as we know. Commercial acid does contain arsenic and sulphur—a few parts per million —but we checked commercial grades against the CP acids and did not find anything particularly different. To be on the safe side, we used CP reagents. While these are not used in the plant, we want to know what we are talking about; and the only safe procedure for these first steps is to use pure acids. We also used distilled water.

A Member: There was, in the early papers, a formula derived which showed that inhibiting effect depended to some extent on sulphur in the inhibitor, and the molecular weight of the inhibitor. Has that been proven or disproven?

Dr. Zapffe: I think that that still stands. It is true that the sulphur content of the inhibitor seems definitely involved in the phenomena we report. Sulphur is an extremely active "promoting" agent for hydrogen absorption.

A Member: You spoke of hydrogen-free steel. The first question is, do you mean hydrogen-free steel from the open hearth or electric furnace, and how are we going to get this hydrogen-free steel?

Dr. Zapffe: That is a good question! Steel can be made by any of the processes so that at the time of solidification it is relatively hydrogen-free. However, that requires a special ladle treatment not practiced as yet today, although we know how to do it. The hydrogen dissolved in the steel at the time of solidification is the so-called "inherited" hydrogen which may have a real effect on the history of that steel or a long time afterwards. Hydrogen remains one of the very few elements not yet controlled in steel-making—this in spite of the fact that the element is unique in certain of its important aspects. By "hydrogen-free" steel, of course, we mean steel that has an especially low content and has not picked up hydrogen after solidification. At the time of casting, the metal usually strikes a mold wall coated with hydrogen-containing moisture or hydrocarbon; in the heat-treating furnaces it is exposed to hydrogen-containing atmospheres; and so on for most of its history. We have

PERMAG
Drawing Compounds

Leading wire mills find PERMAG Drawing Compounds unexcelled as a wire drawing lubricant. PERMAG, not only reduces wear on expensive dies, but also helps bring out wire in better condition and with greater economy.

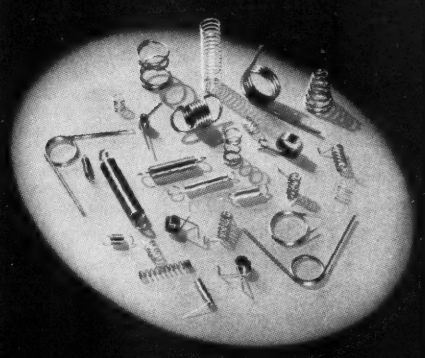
Our trained technicians will be glad to consult with you on lubricants for wire drawing. Write us.

PERMAG
has the following important points that are valued by wire product manufacturers

- assures long life for dies
- is rust resistant
- brings out clean bright wire
- helps your production record

MAGNUSON PRODUCTS CORPORATION
Manufacturers of Specialized Cleaning Compounds for Industrial Purposes
Main Office, 50 Court St., BROOKLYN 2, N. Y.
In Canada: Canadian PERMAG Products Ltd., Montreal - Toronto

Music Spring Wire

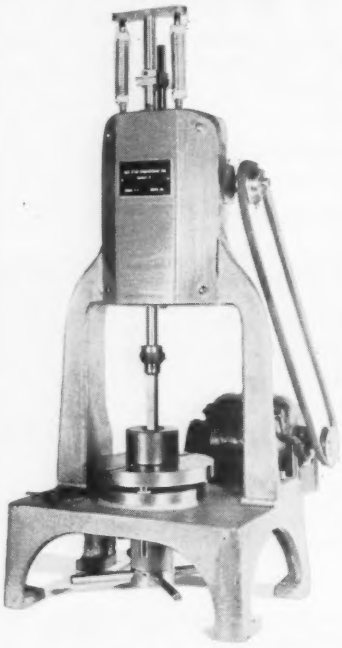


XLO SPRING WIRE is being used successfully to make an endless variety of springs and wire forms.

JOHNSON research and laboratory technicians are constantly studying wire problems to the end that **JOHNSON WIRE** will meet exactly every requirement of the user.

JOHNSON
STEEL AND WIRE COMPANY, INC.
WORCESTER 1, MASS.
New York Philadelphia Cleveland Detroit Akron Chicago
Atlanta Houston Tulsa Los Angeles Toronto

CARBIDE DIE SIZING MACHINE



Designed for extra accuracy and for saving time, labor, and money in your die room.

FEATURING . . .

Entirely new and advanced design for tungsten carbide die finishing.

Opens the bearing of a rough die to within .001" of desired finished hole size.

Rigid and perfect alignment of spindle reduces vibration to a minimum; thus laps faster and produces a smooth finish on lapping surface.

Table adjustable for quickly raising or lowering the die to the proper position.

Table slots for clamping the die firmly in place.

Oilite Bushings throughout.

Prompt Delivery.
Reasonably Priced.

Write today for details and prices.

RED STAR ENGINEERING, INC.

P. O. Box 346
RAHWAY, N. J.

produced relatively "hydrogen-free" steel, but principally on a laboratory scale.

Mr. Findley: I guess there are no more questions. Thank you again, Dr. Zapffe. (Applause.) That concludes our papers for this morning. I guess the bus for Jones and Laughlin leaves at one o'clock, which doesn't leave you too much time, so the meeting is now adjourned.

(Whereupon, at 12 o'clock, noon, the meeting was adjourned.)

Wednesday, October 20, 1948 Sessions

"Wear Resistance of Wire for Wire Rope."

(Continued from Page 57)

all interested in, of course, is a thing that I just looked over hastily. I don't see anything here of the length of the furnaces, of the method of heating the wire before it is lead quenched, or the temperature of the heating, or the length of time in the furnace. We are always interested in those points. Maybe you don't have that information, the length of heating, the temperature of heating, and the time in the furnace?

Mr. Rylands: I am afraid I can't give you the time in the furnace. I have most of the other information. It is a fifty-foot long city gas-fired furnace. The wire is actually in contact with the products of combustion in the muffler. We burn it on the side of the muffler, so to speak. There are hundreds of furnaces of that type in America. The burners are generally the Surface Combustion type. The furnace is under themostatic control. Anywhere between a thousand and a thousand and fifty would be the temperature used on the wire in this report. I am sorry. A thousand Centigrade. We work in Centigrade and you work in Fahrenheit, but it is one thousand fifty Centigrade. Sometimes a fine wire will be dropped to about nine fifty or nine eighty. The wire comes out of the furnace through a hood. It doesn't come in contact with the air at all. The wire comes out of the furnace and plunges straight into the lead, at five hundred degrees,. centigrade. Some of these things were quenched at five ninety. That is out of standard. We can't use that quench. We reckon that after the patenting the structure should be completely free of ferrite and pearlite. We dislike them both.

Mr. Dove: I am sure there must be more wire rope manufacturers who would like to, perhaps, contest this problem of lead patenting against air patenting. I wonder if there is anybody here from Peoria who would like to talk about that?

A Member: I would like to ask one more question. In looking over these tests, I notice your torsions are shown below our usual standard. I notice in one of these the wire which was the best had the lowest torsion and we will have an awful time combatting a torsion test. The best wire here was lead-patented twenty-three torsion, while the eight test wire had forty-one torsion. I presume the torsions are below what is usually required, or what are they—erratic?

Mr. Rylands: No, they are steady, but low for what they usually are for pat-

LET

STANNOCHLOR or STANNOUS SULPHATE

solve your tinning problems

One of these two M & T chemicals will meet all your liquor finishing or immersion plating requirements . . . whether for acid or alkaline . . . white or bronze finish baths.

STANNOCHLOR and STANNOUS SULPHATE are stable . . . will not deteriorate with age in summer or in winter. Their use makes it possible to keep a stock on hand at all times . . . permits purchasing in large quantities for economy.

And, because they contain no water of crystallization, STANNOCHLOR and STANNOUS SULPHATE go further pound for pound.

Write for more complete information.

METAL & THERMIT CORPORATION
120 Broadway · New York 5, N.Y.

ented wire. They will get through most of the standard specifications, but as I say, we were principally interested in supplying wire to our rope industry, and we were quite prepared to pass any wire we thought was satisfactory.

A Member: Now that you have changed over to this new program of making wire rope lead patented, do you still perform tension tests or wear tests or torsion tests, or what sort do you perform?

Mr. Rylands: We still do the classic tests — the tensile torsion and bend, generally speaking. We do the torsion more from the point of view of determining whether there are any surface imperfections than from the number of tests the wire will stand. The value attached to the various tests is, perhaps, not the same as is generally attached in the trade as a whole. So far as wear tests are concerned, those are done periodically. We don't do every batch that way, because we take the view we have established the fact that if you produce the wire from a certain quality of steel a certain way, you will get a certain wear. It is not very much use doing that test repeatedly. We do the check test. It does confirm the work we have already done.

Mr. Dove: If there aren't any more questions, gentlemen, Mr. Rylands will carry on with Mr. Hessenberg's paper. Mr. Hessenberg, of the British Iron and Steel Association, has done a considerable amount of work along the lines of wire research during the last two years and his paper is covered in Wire and Wire Products, October issue, Page 904. Mr. Rylands will go ahead with a discussion of that paper.

Written Discussion, "Wire Drawing in the British Iron & Steel Research Association."

(*Continued from Page 59*)

THERE is one thing that I should like to take this opportunity to say. I am, as you may know, a foreigner in this country, and I should like very sincerely to thank all of you representatives of this great industry in America for the freedom of access to technical information and shop methods, which I think—with the possible exception of Great Britain—could not be experienced in any other country in the world. Thank you, gentlemen.

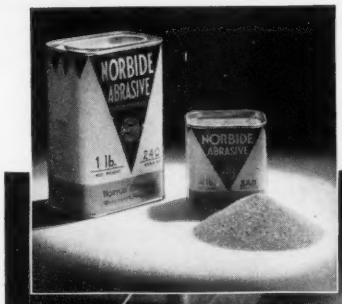
"Wire Drawing in the British Iron & Steel Research Association."

(*Continued from Page 59*)

which had been possible, without loss of quality, when using orthodox machines.

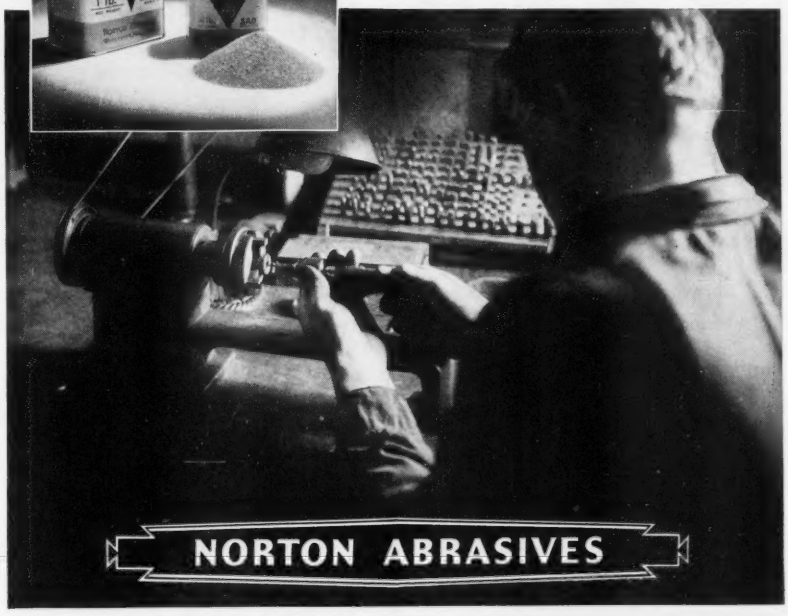
I think it would be unfair for me to ask a lot of questions at this stage which might anticipate the promised publication of the conclusions, but there is one thing I would like to urge on any

NORBIDE Abrasive: Effective, Economical



This abrasive—second only to the diamond in hardness and 150 times less expensive—does an efficient job of cutting and semi-finishing cemented carbide wire drawing dies.

NORTON CO. — Worcester 6, Mass.



EXTRUDERS BY OFFER Control

mpm

MPM offers six-zone control of electrically heated cylinders with nine-eleven or fifteen separate cooling zones for removal of frictional heat or for fast cooling. Higher temperatures—higher screw speeds—higher production—per machine.

Flexibility

These MODERN machines are furnished electrically heated but can be heated or cooled by steam, oil, water, etc. Interchangeable heads and dies to produce covered wire, tubing, rods, strips, wide sheeting are also available along with conveyors, granulators, dryers, etc.

Leadership!

Modern engineering and specialization has resulted in the installation of these machines with 18 of a possible 20 leading material suppliers during the past two years. More complete cooperation with foreign customers too has made MPM the largest exporters of Extruding equipment during the same period.

modern plastic machinery corp. mpm

GREATER *Flexibility* = MORE PROFITS!

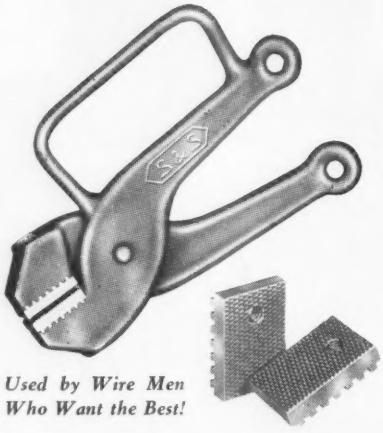
SEND FOR BROCHURE

15 UNION ST., LODI, N. J.

CABLE ADDRESS MODPLASEX

Sjogren . . . PULLERS

A PINCER TYPE PULLER, for use on the older frames, that is properly designed for the work and with jaws that insure a non-slip grip. Four stock sizes are available for a wide variety of work. S & S Pullers are made with replaceable jaws that are also carried in stock. S & S jaws are especially machined on the back to prevent looseness in the holder and which eliminates all strain on the attaching screw.



Used by Wire Men Who Want the Best!

SJOGREN TOOL AND MACHINE CO., INC.

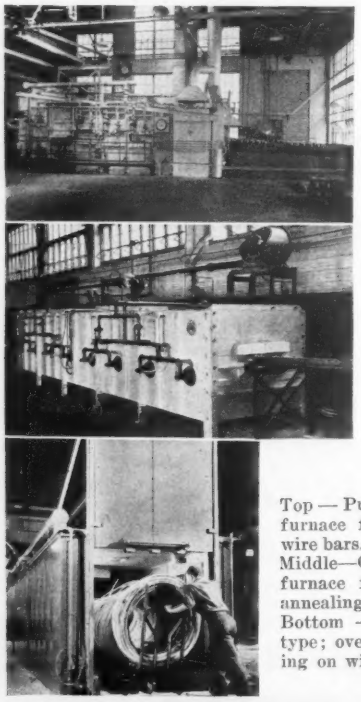
WIRE PULLERS • WEDGE GRIPS • JAWS FOR ALL MAKES OF PULLERS AND TESTING MACHINES • CAGE ROLLERS • SWAGING HAMMERS • POINTING DIES • WIRE SPOOLERS •

14 SWORD STREET
AUBURN
MASSACHUSETTS

For Treating Bars, Rods, Wire, Strip, Springs

install

ROCKWELL FURNACES OVENS • BAKERS SPECIAL MACHINERY



Top — Pusher type furnace for copper wire bars.
Middle—Continuous furnace for bright annealing wire.
Bottom — Tunnel type; oven for baking on wire.

- Rockwell batch or continuous, direct, muffle or radiant tube furnaces of all types for metal heat treating.
- Gehnrich ovens, batch or conveyor types, for aging, normalizing, drawing, baking finishes and protective coatings, and lime on wire rods.
- Coil winding machines, reels and spools; pickling, brushing, cleaning, washing, finishing, drying and handling equipment; special fabrications.

We also design non-ferrous rod mills.

Write for Bulletins

W. S. ROCKWELL COMPANY
242 ELIOT STREET • FAIRFIELD, CONN.

of you gentlemen who may be embarking on experiments of the same nature as those which have been carried out by the B.I.S.R.A., and that is not to lose sight of the indications that it may be possible to derive from the drawing of metals other than the metal in which you may be primarily interested. For example, I myself drew a large quantity of copper and brass, and some of the indications which were difficult to discover when drawing high carbon steel were very clearly discernible when copper and brass were being drawn. Just to quote two examples of this which may have no significance, or which may have a deep significance, we found when we were drawing copper that the diameter of the wire at the point where it first engaged with the die was actually less when a large amount of back pull was applied than it was with the same material drawn without back pull. From this observation we confidently anticipated that the kind of die wear which is known as "ringing" would be appreciably reduced by back pull drawing. Then, again, when we were drawing brass, it was discovered by examination of the cross section of the finished material that the grain structure was noticeably more uniform when drawn under heavy back tension than when the same material was drawn with a slack wire entering each die.

There is one thing that I should like to take this opportunity to say. I am, as you may know, a foreigner in this country, and I should like very sincerely to thank all of you representatives of this great industry in America for the freedom of access to technical information and shop methods, which I think —with the possible exception of Great Britain—could not be experienced in any other country in the world.

Thank you, gentlemen. (Applause.)

Mr. Rylands: I have to thank The Member for his remarks on back pull. Naturally, I only gave my own opinion, and I am very likely wrong, but I wasn't very excited about that quality business in high speed drawing because we have already drawn quite a lot of material at more than double the orthodox speed without the use of back pull, and have had most excellent results from doing it, provided of course proper precautions are taken—adequate cooling and so on—a proper drafting. I simply contend the saving you would get by increased die life and saving of power would be very minute. You all know the proportion which the cost of dies bears to the cost of manufactured wire, and how much the cost of power bears to the total cost of manufactured wire. For that reason, I say the saving you get in those two components is hardly worth crossing the street to pick up, and not, at any rate, to spend a great deal of capital in securing them. Still, as The Member says, time will show and as long as the wire industry exists there will probably be two schools of thought on that and many, many other problems. Each of us would like to say we were right and the other fellow was wrong, and he wants to say he was right and we were wrong, and I think that is the way progress is secured.

I, too, would like to thank the Association and all members here for the kindness they have extended to me—and I am sure my colleagues join with

Harper

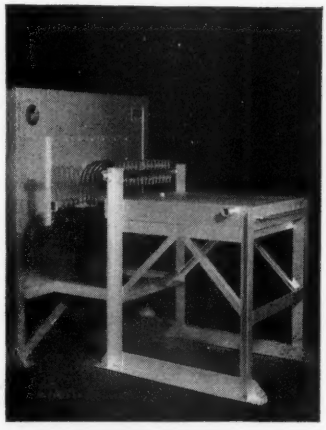
Electric Furnaces

for

BRIGHT ANNEALING

STAINLESS

STEEL WIRE



The above photograph pictures a Harper Furnace specially designed for the continuous bright annealing of 30 strands of steel wire.

The manifold shown distributes hydrogen to 30 tubes which extend through the furnace and through the water-cooled chamber. This furnace is typical of many standard furnaces designed and built by Harper Engineers for the metal working industries.

We will be glad to send you literature on our standard furnaces or work with you on special designs to meet your exact requirements.

HARPER

ELECTRIC FURNACE CORP.

1444 Buffalo Avenue, Niagara Falls, N. Y.

Representatives in all principal cities.

me—in inviting us to this Convention and in showing us so much of the wire industry in this country.

Thank you very much indeed, gentlemen. (Applause.)

Mr. Dove: I think, gentlemen, we have all enjoyed Mr. Rylands' coverage of the papers by Mr. Brown and Mr. Hessenberg, and I am just reminding you again that at one o'clock we have the Annual Luncheon. If there is no further discussion, we will carry on now and complete the morning session and give you time to get yourselves organized and properly wet down for the Luncheon. No further discussion?

I think we all owe a vote of thanks to Mr. Rylands for his very valuable paper and I think you will see a great deal of research carried on in this country on this matter.

Thank you, gentlemen.

(Whereupon, at 11:40 A.M., Wednesday, October 20, 1948, the meeting was adjourned.)

Thursday, October 21, 1948 Sessions

(*Continued from Page* 60)

"Formation and Properties of Martensite on the Surface of Rope Wire."

good job in demonstrating to some of us we have got to think a little differently about martensite and the problem is to get it ductile enough to stand bending without cracking.

Mr. Tatnall: Any further comments, gentlemen? If not, we will thank Mr. Corson and move on to the second paper for this morning on "Quality, Quantity, and Service." Those are three very interesting words, and I know Norman T. Nelson, Jr. from the rod and wire mills of the Bethlehem Steel Company can tell us a good deal about it.

Friday, October 22, 1948 Sessions

(*Continued from Page* 62)

"Aluminum Coating of Steel."

num floated on top of.

Mr. Ulshafer: The only thing I know about the process is what I read in the reprint of the article. That probably doesn't furnish as complete information as you got by being there.

A Member: I have often wondered whether the steel wire drawing industry was suffering from some sort of paralysis that prevented them from following it up.

Mr. Ulshafer: The Sheffield Steel Company has had a pilot plant in what they describe as "successful operation" for about the last four months. They claim they have been able to very closely control their coating thickness and have excellent adherence.

A Member: Are they using Doctor De Guilio's process, or rather the process he described?

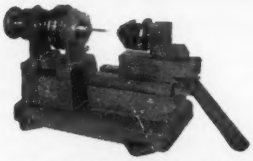
Mr. Ulshafer: That, I don't know.

A Member: The catch about the whole process lies in the fact that there are so many conflicting patents. I don't think anybody could approach the subject without finding about sixteen filed claims to the same rights.

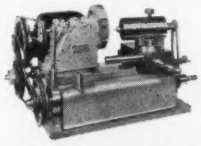
NEW

ROOS MACHINES for the DIE ROOM

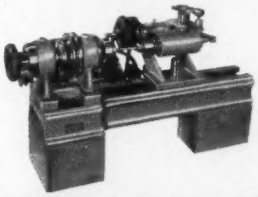
- **ROOS PIN MAKER**



- **ROOS PRECISION PIN GRINDER**



- **ROOS AUTOMATIC POLISHERS**



A COMPLETE LINE OF LAPPING MACHINES, DRILLERS AND POLISHERS TO SPEED UP PRODUCTION IN YOUR

DIE ROOM

WAKE IT UP

with ROOS

DIE FINISHING MACHINERY

ROOS TOOL & MFG. COMPANY

Plant and Shipping Point
17 Grove Street, Montclair, N. J.

Sales Office
49 Bloomfield Avenue, Newark 4, N. J.

NILSON

AUTOMATIC PRESS
and
FOUR SLIDE MACHINE

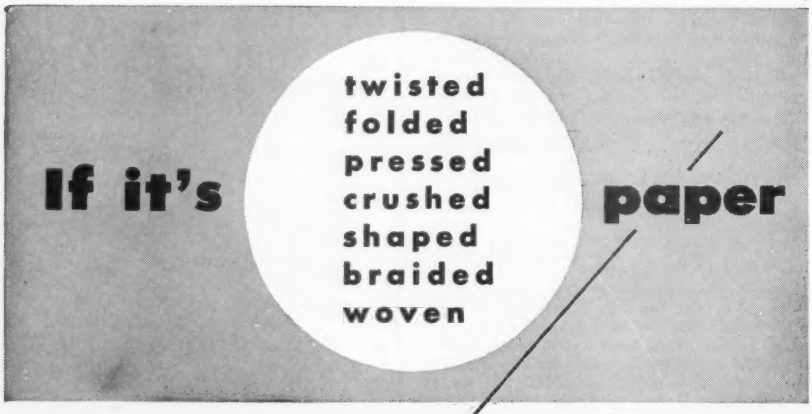
FOR SWAGING, STAMPING, PIERCING, BLANKING,
FORMING OF COILED METAL

We also build machines for forming Paper Clips, Buckles, Gate Hooks, Coat and Hat Hooks, Ceiling Hooks, Wire Ears, Cable Rings, Screw Eyes, Sash Chains, Automobile Side Chains, Flat Open Link Chains, Staples, Cotter Pins, Hose Clamps, Etc., and Wire Straighteners, Wire Reels, Frame Bending Machines and Special Presses.

For Complete Details Address—

THE A. H. NILSON MACHINE CO.

BRIDGEPORT, CONN., U. S. A.



TWITCHELL makes it

fine, treated yarns wound 4 ends parallel for high-speed wrapping by new Abbo-sealed process will be available soon.

waxed cable-filler for 2- and 3-wire non-metallic sheath cable and ship-board cable.

wire-rope cores

braiding and wrapping yarns for electrical cable.

E. W. TWITCHELL INC.
Third & Somerset Streets,
Philadelphia 33, Pa.

That is the first gimmick. The second is that nobody has found any way of successfully controlling tensile strength after immersion in the bath at thirteen hundred degrees or higher except by drawing.

A Member: The drawing of the coating is limited to twenty-five per cent?

A Member: So far.

A Member: Didn't Doctor De Guilio use a sample drawn at eighty per cent?

A Member: The catch about it is there is still limited drawing and there will be so long as the aluminum-iron alloy is brittle. That is about the size of it. If someone can put on a heavy coating of pure aluminum with a smaller body of aluminum-iron alloy you could do more drawing. It is like drawing hot zinc coated material when you let it stay in the bath too long and your formation of alloy goes on too far—the alloy is brittle. I checked over most of the available patents for this particular job and in every case they conflicted, and I believe they are going to stay conflicting until somebody proceeds to fight a patent; and I think that is the whole catch—no one wants to let himself go hog wild to the extent of publishing his system until he has covered all the patents.

A Member: You have made a point about properties—in maintaining physical properties at such a high temperature. Does that apply to such things as fence wire?

A Member: Well, of course, not to fence wire.

A Member: There is your big field.

A Member: One application I was particularly fond of was that of telephone wire. You can get them by quenching. I just wanted to bring that particular point up. I think that is why everyone is keeping quiet about it, until he can see his way clear to speak up about it. The easiest method so far is the method outlined by Doctor De Guilio.

A Member: Thank you. I remember now you told me all that last spring, and I forgot it.

A Member: What is the influence on the die wear? The last speaker brings up the point by pulling it through the bath—through this protective layer — this oxidizing is prevented. I am in doubt about it and the wear on the die. Can anyone answer that question?

A Member: I don't think anyone has done enough to find out the die wear. I have drawn a little bit of it.

Mr. Gonser: Is there anyone here from the American Rolling Mill Company familiar with their wire drawing procedure? They happen to be the only company, to my knowledge, commercially able to make the aluminum wire now.

I might add a couple more notes. The important thing, aside from patenting of a technical nature is the trouble in getting rid of imperfections on the surface of aluminum coated steel, and adherence. Both of them can be overcome, but it is not easy, and certainly not as easy as galvanizing. Right now I think all of us who have had experience with aluminum coated steel consider it is more difficult than galvanizing. It is possible to use it without a flux, but it is a difficult operation. One other item, you mentioned the great importance of the alloy layer, which I think all of us agree contributes so much to the brittleness of the coating. Just as with galvanizing, some constituents can be added to the bath to make that

alloy layer a lesser amount so it is not so thick, so with aluminum coated steel there are additions which can be made which will greatly decrease the alloy layer. I think ahead of us we have a lot of technical advances which will probably be carried out in the next few years and make that a much more important topic to be discussed several years from now. I happened to think of it, and got up. Carry on if you have any comments. Are there any other items you want to bring up? If not, thank you very much. I have been very pleased to have so much discussion of this paper. (Applause.)

Mr. Gonser: Going on, then, to the next paper in the series, we have "The Processing of Brass Wire" by Christian Witteveld. Will he please present the paper?

★ ★ ★

How Corrosion by Salt and Salt Solutions Can Be Overcome Told in New Booklet

THE part played by corrosion control in the production of salt, and in the use of brine solutions by chemical and food processors, is described in a new 20-page booklet just issued by **The International Nickel Company, entitled** "Salt as a Corrosion Problem."

★ ★ ★

THE booklet contains a minimum of ancient history. Its contents are about equally divided between a discussion of corrosion problems solved by the salt industry, and equipment for handling brine solutions in the chemical and process industries.

★ ★ ★

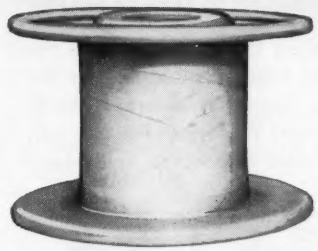
"THE American salt industry, with its high-purity requirements and low bulk prices, represents one of the major triumphs of chemical engineering science," the booklet points out. "But salt production was an old and basic industry long before chemical engineering was dreamt of. One reason for this apparent technical paradox is the alertness of modern salt producers to study and apply new engineering methods, and to adopt suitable equipment after test."

★ ★ ★

THIS publication is available without charge through The International Nickel Company, 67 Wall Street, New York City.

★ ★ ★

FOR HIGHEST SPEEDS

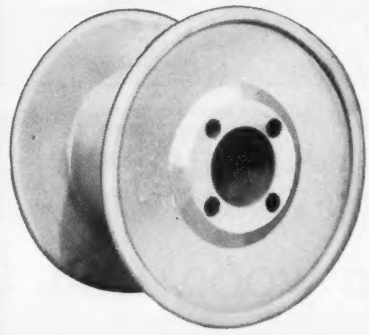


APCO MOSSBERG

PRECISION

STEEL REELS

The reels that are engineered to the job... designed and built by the company that originated the steel reel idea . . . are the reels you should be using in your plant. Every year, more and more Apco Mossberg Steel Reels are bought by quality-minded buyers throughout the wire industry.



FREE

ENGINEERING SERVICE

Without obligation to you, Apco Mossberg engineers will be glad to study your reel problem, and supply complete suggestions, drawings, blue prints. Write for information today. *Canadian Representatives:* Hugh Williams & Company, 47 Colborne St., Toronto, Ontario. *Pacific Coast Rep.,* Jack P. Williams, Jr., Matson Building, 215 Market St., San Francisco 5, Calif.

REELS . . . SPOOLS . . . BOBBINS

APCO MOSSBERG COMPANY

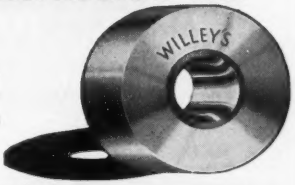
(THE ORIGINAL FRANK MOSSBERG CO.)

21 LAMB ST., . . . ATTLEBORO, MASS.

WILLEY'S DIES LAST MUCH LONGER

SPECIFY WILLEY'S SIZING, EXTRUSION and WIRE DRAWING DIES

Pioneers in the manufacture of wire forming dies, Willey's is in position to make dies to your specifications that give superior performance, cut production costs and hold tolerances for long runs.



There are standard one-piece round dies, available from stock in many sizes — as well as four classifications from blank and rough cored nibs to finished dies, ready to use.

WRITE FOR CATALOG

Full information on all sizes and classifications, as well as hundreds of Willey's Tools for other uses.

WILLEY'S CARBIDE TOOL CO.

SOLE MAKERS OF WILLEY'S METAL

1342 W. Vernor Highway Detroit 1, Michigan

Complete information will be sent upon request. Ask for Bulletin MHT.

WIRE HARDNESS

By checking grain hardness with the Eberbach Micro Hardness Tester the user can accurately determine hardness of very fine wire. For use with metallurgical microscope equipment.

Eberbach & Son Company
Ann Arbor, Mich.
Laboratory Apparatus & Supplies
Established 1843

REELS SPOOLS

ALL SIZES

WOOD- PLYWOOD -WOOD-METAL

RETURNABLE NON-RETURNABLE

Samples and Prices on Request

DURKEE MFG. CO. PINE RIVER, MINN.

HOWSAM SPOOL COMPANY

500 RATHBONE AVE AURORA ILLINOIS

Phone 2-3043

Catalog Covers Amsler Testing Equipment

NEWLY designed Amsler testing machines for wire mill and other uses are fully described in a recently-issued catalog.

★ ★ ★

THE machines covered are a universal testing machine that has a capacity up to 60,000 lbs. tension or compression; a spring testing machine for rapidly testing coil springs; a combined stress-fatigue for repeated torsion or bending tests or combinations of the two; a small horizontal tensile testing machine for tensile testing fine wires, yarns, fibres, etc.; and a cold bend testing machine of 70-ton capacity for round and flat bars. All machines are simple, rugged, accurate and hydraulically operated and designed for use in the metallurgical laboratory.

★ ★ ★

THE catalog, with illustrations, specifications, descriptions and prices will be sent to our readers upon addressing **Dept. W., Adolph I. Buehler,** 228 No. LaSalle St., Chicago 1, Ill.

★ ★ ★

Fansteel Issues Important Bulletin On Inert Gas Welding

INERT gas welding, the process now uppermost in the minds of industrial welders large and small, as a business, or as an essential part of manufacture, receives an important contribution in a bulletin just issued by **Fansteel Metallurgical Corporation.** The bulletin is practical and helpful in its information to all who are using or contemplating use of helium, argon or atomic hydrogen arc welding, methods which are revolutionizing the welding industry.

★ ★ ★

SPECIFICALLY the new Fansteel Bulletin deals with the Tungsten Electrodes, vital factor of inert gas welding's success. Absolutely necessary for perfect and uniform character of the welding is arc stability. For this purity of the Tungsten is essential. Pure Tungsten melts at 6152°F., the highest melting point of all metals. Its vapor pressure (0.000005-mm at 4580°F.) is the lowest of all metals. It is these properties which make tungsten useful as an electrode material. Fansteel Tungsten Electrodes are 99.9+ per cent pure Tungsten. Beginning with premium wolframite ore, every step of the production of Tungsten at the Fansteel plant is under the control of trained metallurgists and quality control engineers. Every electrode must pass rigid inspection for cracks, surface impurities, dimensional errors and other imperfections.

★ ★ ★

THE Bulletin illustrates from actual photographs the uniform clean welds, without grinding or polishing, made by inert welding with Fansteel Electrodes. Copies may be had by addressing Fansteel Metallurgical Corporation, North Chicago, Ill. Ask for Bulletin 1,102.

★ ★ ★

Study On Carbide Die Construction Issued

FOR the past several years, carbide dies have been taking the place of other die materials in almost every phase of the stamping, forming and drawing of metals, according to **Allegheny Ludlum Steel Corporation.** "In the past year, the carbide die program has been greatly accelerated, due largely to the effects of the carbide manufacturers and a few of the foremost precision die builders of the country," it is stated. "Of these, the Allegheny Ludlum Steel Corporation played a most important part, being a major producer of carbide; and with one of the largest lamination stamping departments in the country, a very natural setup for carbide die development was presented. Tests were run, dies were built, and results were obtained. All types of dies were built, tried, and developed. Methods of construction were developed and standard procedures adopted.

★ ★ ★

ALLEGHENY Ludlum does not build dies commercially; however, as a large producer of special steels, it is interested in developing processes for fabricating these alloy steels, especially electrical and stainless.

★ ★ ★

ALTHOUGH the carbide die building program has developed rapidly, it does not play the part in American high production which it should, largely because carbide is still considered by many as a hard, brittle material which cannot be machine ground, will not resist shock, or stand strain in any manner."

★ ★ ★

IN order to familiarize die users with practices generally adopted in the manufacture and construction of carbide dies, Allegheny Ludlum has issued a study broken down into four steps generally considered when building carbide dies. The simplification of the discussion is based on building a simple draw die for the first draw operation in a deep draw job, using 1/16" cold rolled material having an I. D. of 4".

★ ★ ★

THIS discussion may be obtained from the Engineering Staff, Carbide Alloys Division, Allegheny Ludlum Steel Corporation, Ferndale, Mich.

★ ★ ★

Folder Covers Wire and Strip Mill Furnaces

W. S. ROCKWELL, 50 Church Street, New York 7, N. Y., has issued an illustrated folder entitled "Rockwell Wire and Strip Mill Furnaces." It not only shows pictures of the several types, but has schematic diagrams of them.

★ ★ ★

THE furnace types covered are for annealing, bright annealing, clean annealing, galvanizing, hardening, heating, normalizing, patenting and tinning, using oil, gas or electricity to provide heat.

★ ★ ★

PLEASE write the Company for your copy of this informative folder.

★ ★ ★

WE BUY WE SELL

We Pay Highest Prices for Used Machinery

FOR SALE

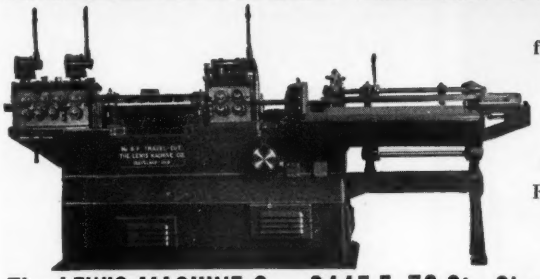
2 ENTWISTLE REWIND STANDS
Complete with automatic predetermined length counter, spark box and controls.

TAPING HEADS - all types
WARDWELL BRAIDERS
TAKE-UP STANDS - all sizes

All Machines Reconditioned in Our Own Shop

WIRE & TEXTILE MACHINERY INC.
P. O. BOX 436, PAWTUCKET, R. I.

LEWIS TRAVEL-CUT WIRE STRAIGHTENING and CUTTING Machines



Machines for 1/16" to 3/4" rod
Round
Square
Flat
Hexagon
Ferrous and Non-Ferrous

Automatic
High Speed
Heavy Duty

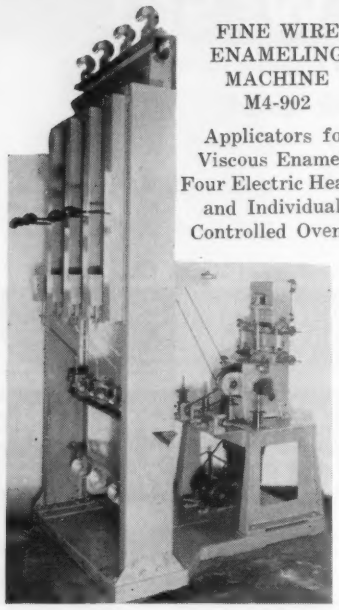
LEWIS

The LEWIS MACHINE Co., 3445 E. 76 St., Cleveland, O.

EASTWOOD WIRE
CENTRIFUGALLY-CAST FOR QUALITY

Phosphor Bronze — WIRE, FLAT
Nickel Silver — WIRE, ROD

Eastwood-Nealley CORPORATION
Belleville 9, New Jersey



FINE WIRE ENAMELING MACHINE M4-902

Applicators for Viscous Enamels Four Electric Heated and Individually Controlled Ovens

EST. 1888 AIMCo INC. 1918

"American" INSULATING MACHINERY COMPANY

517 W. Huntington St.
Philadelphia 33, Penna., U.S.A.

STEEL WIRE

by MAURICE BONZEL

* * *

Translated and Published by

Kenneth B. Lewis
Consulting Engineer

* * *

Price $15.00

* * *

495 pages—414 illustrations

* * *

SEND ORDERS TO

WIRE and WIRE PRODUCTS

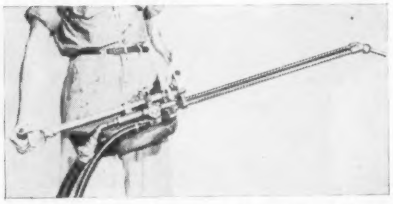
300 Main St., Stamford, Conn.

New Oakite Steam Gun for Cleaning

OAKITE Products, Inc., have announced the addition to the company's line of steam-cleaning equipment of the Oakite Solution-Lifting Steam Gun, Model 481, designed to facilitate volume cleaning operations in industrial plants.

★ ★ ★

THE outstanding feature of this new gun is its ease of handling, made possible by its special construction. The gun, with an over-all length of five feet, is ruggedly constructed and so balanced that it may be used over extended periods without tiring the operator. Two spade-type, insulated handles are provided on the gun, and are



Solution-Lifting Steam Gun, by Oakite * *

so situated that each of the operator's hands support the same weight during a high pressure steam-cleaning operation. The forward handle of the gun remains stationary in the operator's grasp as the gun is rotated, while the rear handle is easily turned to rotate the gun when cleaning hard-to-reach surfaces. Steam and solution hoses are connected to the gun by swivel joints and remain stationary when the gun is rotated thus eliminating twisting of hose lines. A safety feature is a reinforced rubber apron backing up the hot fittings to protect the operator.

★ ★ ★

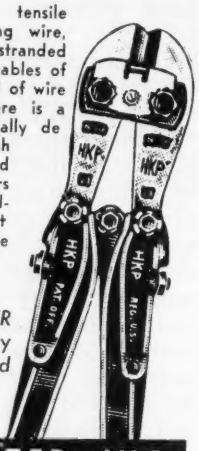
THE Oakite Solution-Lifting Steam Gun, Model 481, develops sufficient vacuum to discharge cleaning solutions to a height of over 12 feet to permit rapid, thorough cleaning of large-equipment surfaces. Readers desiring additional data regarding this new steam gun may obtain it, without charge, by addressing Oakite Products, Inc., 152A Thames St., New York 6, N. Y.

★ ★ ★

PORTER Cutters

the POWER *line*

For cutting high tensile strength wire, spring wire, hard wire rope, stranded guy wire, tie wire, cables of all kinds — any kind of wire hard or soft — there is a Porter Cutter specially designed to do each job faster, easier and safer. Porter Cutters are practically standard equipment throughout the entire wire industry.



SEND FOR FOLDER showing the newly designed *improved* Porter Cutters.

H. K. PORTER, INC.
74 Foley St. Somerville, Mass.

New Drum Pump Handles Heavy Grease or Light Fluids

SPECIAL spider design of the piston and intake opening provides a cut-through action and large capacity that handles any fluid, which seeks its own level, except lacquer thinners. Heavy greases are pumped at rates up to 3 gallons per minute and even higher for alcohol and other light fluids, (Smooth flow is maintained as air pressure, created by pump action, eliminates splashing and waste.

★ ★ ★

INSTALLATION is easy and rapid, pump simply screws into drum bung. The bung bushing fits both 2" and 1½" barrel openings on 15, 30 and 60 gallon drums.

★ ★ ★

WRITE to **General Scientific Equipment Company,** 2700 W. Huntingdon Street, Philadelphia 32, Pa., for descriptive literature.

★ ★ ★

BORAX
for
Wire Drawing

After pickling, BORAX can be applied with one dip; dries in three minutes in an oven temperature of 150° F. to provide a coating that will not check or flake off in storage. Dissolves readily in water and is dust free. BORAX, other than being an excellent vehicle for picking up the drawing lubricant, is rust inhibiting and a natural flux that will facilitate the making of good butt welds. Use BORAX to make better wire at less cost. Used in many mills.

Send for complete particulars

PACIFIC COAST BORAX CO.
51 Madison Ave., New York 10, N.Y.

Oakite Holds Annual Technical-Sales Meetings

HOW recent developments in the field of cleaning and allied procedures are helping industry to combat rising production costs, was the central theme of a series of technical-sales conferences held in New York, Chicago, and Kansas City during November by Oakite Products, Inc.

★ ★ ★

THE first of these regional conferences, held in New York, incorporated a program of lectures and round-table discussions attended by field service representatives of the company's New England, New York, Philadelphia, Southern and Canadian sales divisions. Highlighted on the conference agenda were special reports delivered by Oakite research chemists, service engineers and technical specialists on latest trends in cleaning and associated materials for the food processing, dairy products, metals, petroleum and railway transportation fields. Also discussed were new Oakite materials and equipment to be made available to industry during the coming year.

★ ★ ★

SIMILAR conferences held in Chicago, and Kansas City, were attended by Oakite field service representatives from the Chicago, Detroit and Central divisions, and the Pacific Coast, Midwestern and Southwestern sales territories respectively.

★ ★ ★

To Hold Seminar on Standardization

A PRIVATE five-day seminar on the organization and technique of standardization work, particularly in individual companies, will be held from January 24 through 28, 1949, in Room 503, Engineering Societies Building, 29 West 39th Street, New York City, by Dr. John Gaillard. Dr. Gaillard is mechanical engineer on the staff of the American Standards Association and lecturer in industrial standardization at Columbia University. The seminar will consist of ten conferences, two being held every day, at 9:30 a. m. and 2:00 p. m. At each conference Dr. Gaillard will present a lecture which will be followed by round-table discussion of questions of special interest to those attending.

★ ★ ★

PREVIOUS seminars of this kind held in 1947 and 1948 were attended by representatives of industrial concerns, the Armed Services, a prominent engineering college, and two foreign national standard bodies.

★ ★ ★

FOR details concerning registration, write Dr. Gaillard at his home address, 400 West 118 Street, New York 27, N. Y. or phone him at ASA headquarters, Murray Hill 3-3058.

An ADVERTISER likes to know his ads have been read so please mention WIRE & WIRE PRODUCTS when writing him.

Better Way To Coat Wire

The Oakite CrysCoat* Process offers five big advantages:

1. *Longer die life*
2. *Shorter downtime*
3. *Superior rust-resistance*
4. *Cleaner, brighter wire*
5. *Increased production*

Write today to arrange for free demonstration by an experienced Oakite Technical Service Representative.

** Reg. U.S. Pat. Off.*

OAKITE PRODUCTS, INC.
52A Thames Street, NEW YORK 6, N. Y.
Technical Representatives in Principal Cities of U. S. & Canada

OAKITE
REG. U. S. PAT. OFF.

Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

DIAMOND TOOLS

by

Paul Grodzinski

PRICE $5.00

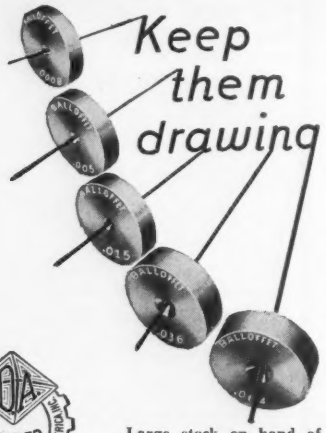
This book is concerned with industrial diamonds and other precious stones. It gives information about their production and qualities, their cutting and uses and, of course, devotes considerable space to the use and manufacture of diamond dies for wire drawing. One chapter is devoted to diamond powders.

Besides being profusely illustrated, there are many reference tables providing much useful data. An effort has been made to treat every phase of the subject in a practical and helpful manner. If you are making diamond dies or tools, or using them, you cannot afford to be without this book.

You may order it from this office. Just send check or order to:

WIRE & WIRE PRODUCTS
300 Main Street Stamford, Conn.

Balloffet
DIAMOND DIES



Large stock on hand of domestic and imported dies available for immediate shipment in sizes from .0004" to .081".

BALLOFFET
DIES AND NOZZLE CO., Inc.
6825 Adams St., Guttenberg, N. J.
Quality Diamond Dies Since 1870

INDIANA
DIAMOND DIES AND
TUNGSTEN CARBIDE DIES
ALL SIZES
AND SHAPES
• •
DIAMOND POWDER
• •
DIAMOND TOOLS
• •
Address inquiries to
INDIANA WIRE DIE CO.
314-324 E. WALLACE ST.
FORT WAYNE 6, INDIANA

A Review of Recent Wire Patents

(*Continued from page* 83)

NO. 2,454,935, CONTINUOUS WIRE AND STRIP ELECTROPROCESSING MACHINE, patented November 30, 1948 by Constantine G. Miller, Chicago, Ill., assignor to The Meaker Company, Chicago, Ill., a corporation of Illinois.

This apparatus resulting in this patent is a continuation in part of an application terminating in patent 2,431,065. Self-adjusting and self-protecting contact fingers conduct the current to the wire strands.

★ ★ ★

NO. 2,454,964, BED SPRING, patented November 30, 1948 by Charles J. Elder, Muncie, Ind., assignor to The Moore Company, Muncie, Ind., a corporation of Indiana.

The assembly includes rows of spring elements having their lower ends secured to a base frame and being of flat spring stock bent into a substantially S-shape with their other ends secured to a border frame.

★ ★ ★

NO. 2,454,965, BED SPRING, patented November 30, 1948 by Charles J. Elder, Muncie, Ind., assignor to The Moore Company, Muncie, Ind., a corporation of Indiana.

The springs in this patent are of wire, bent to provide an upper stretch and end stretches each including at least one helical turn, the upper stretches being coplanar.

★ ★ ★

NO. 2,454,997, METHOD OF FORMING EYES ON WIRE, patented November 30, 1948 by Israel Diamond, Washington, D. C., assignor of one-fourth to Ruth Diamond, one-fourth to Doris Diamond, one-fourth to Mildred Diamond, and one-fourth to Herbert H. Diamond, all of Washington, D. C.

This method is applicable to steel wire and consists in bending the end of the wire into the form of a U having a short leg and a long leg, bending the short leg at a point adjacent the base of the U substantially at right angles and across the long leg with the long leg overlying the short leg, then while holding the two legs in this position twisting the loop thus formed at the base of the U about the axis of the short leg through an angle of approximately 360° so that a wrap is made about the short leg, then bending the free end of the short leg through an angle of approximately 90° toward the loop and generally in the plane of the loop to form a knot.

★ ★ ★

NO. 2,455,346, WELDER FOR WIRE MESH FABRICS, patented November 30, 1948 by Charles C. Wickwire, Cortland, N. Y., assignor to Wickwire Brothers, Inc., Cortland, N. Y., a corporation of New York.

VIANNEY
Famous Wire Drawing Diamond Dies

All sizes from .080 down to .00039 in stock from New York.

Appropriate profiles available for soft, medium and hard metals or to your specifications.

VIANNEY WIRE DIE WORKS
250 E. 43rd St., New York
V. J. Boulin, Manager

It is stated that this welder is related to that disclosed in patent 2,451,423 dated October 12, 1948. The two lower electrodes of that invention are eliminated in favor of a copper electrode bar.

★ ★ ★

A. S. & W. Donora Furnace Operates Seven Years Continuously

NO. One blast furnace at the Donora (Pa.) Steel & Wire Works of **American Steel & Wire Co.**, U. S. Steel subsidiary, has been blown out for relining after producing 2,003,500 net tons of pig iron. Blown in on January 18, 1941, the furnace has been in continuous operation for seven years and nine months, with an average daily production approximating 700 net tons. The rated capacity is 600 net tons per day.

★ ★ ★

ESTIMATES range from 60 to 65 days to complete the relining project. The A. E. Anderson Construction Co., of Buffalo has the relining contract, while the American Bridge Co., will do the structural work.

★ ★ ★

DIAMOND DIES .0006 - .120 DIAMOND POWDER
INDUSTRIAL
AJAX
SUPPLIES INC.
R.R. 4, P.O. Box 66, Fort Wayne, Ind.

NEW ENGLAND WIRE DIE CO.
7 Forsberg St., Worcester, Mass.
EXPERT RECUTTING
DIAMOND DIES, DIAMOND POWDERS
Eastern Representative of
Ajax Industrial Supplies, Inc.

DIAMONDS for WIRE DRAWING DIES and CUTTING TOOLS
DIAMOND POWDER UNIFORM QUALITY
CHAMPION DIAMOND COMPANY, INC. 551 Fifth Ave., New York 17

DIAMOND DIES
.000's to .102
Fort Wayne Wire Die Inc.
2625 E. Pontiac St. Fort Wayne, Ind.

DIAMOND CARBIDE
DIES
KELLY
WIRE DIE CORPORATION
19 W. 34th St. New York

DIAMOND AND CARBIDE WIRE DRAWING DIES
RUSCH WIRE DIE CORPORATION
Croton-on-Hudson, N. Y.

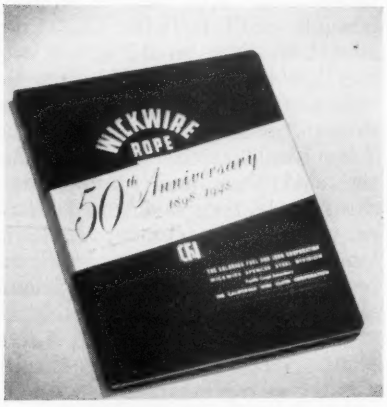
L & H DIE COMPANY
Specialists in all types of
TUNGSTEN CARBIDE DIES
Namely Rounds, Squares, Flats, Hexagons, Extruding and Special Shapes.
Also Mandrels in all sizes.
RFD #4, Box 504-B, Royal Oak, Mich.
Telephone: Lincoln 1-8788

CONSULTANT AND SPECIALIST
DRAWING LUBRICANTS
Hans C. Bick, Inc.
READING, PA.

Anniversary Catalog Marks Fifty Years of Rope Making

THE fiftieth anniversary (1898-1948) of wire rope making at the Wickwire rope mill at Palmer, Massachusetts is a fitting time to issue this catalog. The new Wickwire Rope catalog offers a different approach to a difficult subject. New charts, tables, drawings and photographs were included to present a fresh slant on wire rope. The text has been written so it is pleasing to the technical man and is still understandable to the layman.

★ ★ ★



Wickwire Spencer Fiftieth Anniversary Catalog of Rope Making

THIS new catalog has three indexes that permit quick reference to the contents. The first section covers the characteristics of wire rope. The second section has been divided into six parts, describing wire rope for specific industries. The third section deals with the highly important subject, the care and handling of wire rope. Factual and yet interesting the catalog carries the reader to his destination by the shortest route without passing by any points of real interest.

★ ★ ★

YOU can secure your copy without obligation by writing to **The Colorado Fuel and Iron Corporation, Wickwire Spencer Steel Division,** 500 Fifth Avenue, New York 18, New York.

★ ★ ★

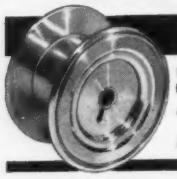
Wire Drawing Diamond Dies
COCHAUD
WIRE DIE CORPORATION
300 W. 56th St., NEW YORK
Tel. COlumbus 5-1340

WIRE DRAWING, EXTRUSION, HEADING and SHAPED DIES
Mandrels and Wear Resisting Tungsten Carbide Parts.
EASTERN TUNGSTEN CARBIDE CO.
40 E. Bigelow St., Newark 5, N. J.

Finishing and Recutting Diamond and Carbide
Wire Drawing Dies our specialty
HOOSIER CARBIDE DIE, INC.
P. O. Box 423, FT. WAYNE, IND.

WAYNE WIRE DIES STAND FOR
QUALITY • QUALITY • QUALITY
in both DIAMONDS AND WORKMANSHIP
Highest quality dies manufactured for those who produce quality wire. Insist on the name "WAYNE" if you want long die life, high wire production and good wire.
WAYNE WIRE DIE CO. 200 PENNSYLVANIA AVE., HILLSIDE, N. J.
Phone EL 2-2456 For Prompt Service

TOOLS TALIDE DIES
WEAR PARTS
Talide Metal, the super hard tungsten carbide gives increased production, better finish, less down time and scrap on all wire mill operations.
METAL CARBIDES CORPORATION
YOUNGSTOWN 5, OHIO


ACROPAK
Drawn Aluminum Alloy Spools for Precision Wire Packaging
ACROMETAL PRODUCTS, INC.
604 Fifth Street North
MINNEAPOLIS 1, MINNESOTA

WIRE SPOOLING MACHINERY
ALL TYPES—ALL SIZES
ROBERT J. EMORY COMPANY
Sherman Ave. & Runyon St.
Newark 5, N. J.

WATER PROOF and CREPE PAPER
in rolls of any size for wrapping coils and reels.
CREPE-KRAFT BARREL LINERS
THE CREPE-KRAFT COMPANY
Division of National Waterproof Papers Inc.
Camden, N. J.

101 ENGINEERING VERSATILITY
Engineered Application of Heat in Continuous Materials Handling Systems
INDUSTRIAL OVENS, INC.
13825 TRISKETT ROAD
CLEVELAND 11, OHIO

HAVEG CORPORATION
NEWARK, DELAWARE
Manufacturers of Plastic Chemical Equipment

SPECIALISTS IN
DRAWING COMPOUNDS
and
SOAP POWDERS
for
WIRE DRAWING
Established in 1906
NEIL C. POTTER
24 COMMERCE ST.
NEWARK 2, N. J.

54 Years in the Wire Business

(*Continued from page* 38)

joint machines with 2½ men per machine will produce 1200 rods in 8 hours as compared to 5 men per machine to turn out an average of 500 rods per 10 hours.

* * *

LOOKING back over the years, the changes that have come about in machinery and methods of operation are little short of amazing. I'm glad to have been on hand to see these improvements and it can't help but be a source of sorrow to me that many of the old timers who made today's progress possible can't be with us. I am sure that they would agree with me that in the past 25 years the industry has made greater strides than in the entire previous century. They would rejoice with me that the old rough and tumble years are now history and that because of improved machinery it is no longer necessary for wire mill superintendents to jeopardize friendships of many years standing by stealing wire workers from a rival plant. I can remember in the beginning of my association with the Atlantic Steel, when it took years to train a good wire mill man, that I made annual trips north to hire men for our mill. In those days there was little skilled labor in the South and we coaxed many a wire drawer and nail operator down our way with a story supplied by the Chamber of Commerce on the glories of the Georgia climate.

* * *

FIFTY-FOUR years in the business is a long time. I've seen many changes in faces, changes in the industry itself and I only greatly regret that I won't be around for 54 more years to have a hand in the progress ahead—for gentlemen, in my opinion the wire industry should change even more in the years to come. Such fellows as John Mordica, George Paff, the Igoes, Frank Nullmeyer and others of us old timers had the courage to experiment with lubricants, with dies, with new machines and methods of operation. We convinced folks that the wire end of

MUSIC WIRE
For Mechanical Purposes
Plain Polished, Tinned, Straightened and Cut Lengths
Fine Sizes — Special Wires — Strands and Cables — Spooled and Coiled Wires

Aluminum	Pure Iron
Annealed	Pure Nickel
Brass	Resistance
Copper	Stove Pipe Wire
Florists	Stainless
Monel	Straightened and Cut
Music Wire	Tag Wire
Nickel Silver	Trolling Wire
Oil Tempered	Leader Wire
Phosphor Bronze	
Picture Wire	

THE MALIN & CO.
2514 Vestry Ave., Cleveland 13, Ohio

CHEMICAL-PROOF CONSTRUCTION
LININGS TANKS HEATING UNITS
Crates, Yokes, Baskets
Rubber Koroseal Plastics Brick
Monel Stainless Lead
Impervious Graphite
HEIL PROCESS EQUIPMENT CORP.
12905 Elmwood Ave. Cleveland, Ohio

AD THOUGHT

May we suggest that reading the ads be made a regular habit. And when you write to an advertiser for information, it helps us and identifies your inquiry to say you saw the ad in WIRE AND WIRE PRODUCTS Will you do this?

ZINC STRIP AND WIRE
THE PLATT BROS. & CO.
WATERBURY 90, CONN.

RUESCH
Machinery For
Wire, Tube, and Brass Mills
409 Mulberry Street, Newark, N. J.

SLEEPER & HARTLEY, Inc.
Designers and Builders
SPRING COILERS
WIRE WORKING MACHINERY
WIRE MILL EQUIPMENT
SPECIAL MACHINERY
Address Inquiries to
Box 1249
WORCESTER, MASS.

THE MONTGOMERY COMPANY
Established 1871
25 CANAL STREET
WINDSOR LOCKS, CONN.

BARE ELECTRIC TINSEL CONDUCTOR and RESISTANCE TINSEL CORDAGE • TINSEL LAME • DECORATIVE TINSEL THREADS, CORDS, LAMINETTES

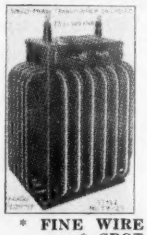
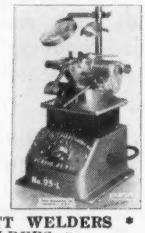
WIRE SPOOLING
STRAIGHTENING and CUTTING
PAPER and COTTON SERVING
BRASS, BRONZE, COPPER & STEEL WIRE IN STOCK
PARAMOUNT WIRE COMPANY
100 Bleecker Street
New York 12, N. Y.

Specify **SAUEREISEN**
ACIDPROOF CEMENTS—COMPOUNDS FOR
Tanks, Sewers, Stacks, Floors
Technical cements for all purposes.
Send sketches or samples
Sauereisen Cements Company • Pittsburgh 15, Penna.

Annealing Pots and Boxes
Galvanizing Kettles
Lead and Spelter Pans
Pressure Vessels
National Annealing Box Co.
Established 1895
Washington, Penna.

DI-ACRO Bender No. 1
forms round, flat or square wire to accurately duplicated shapes.
Send for Catalog
O'Neil-Irwin Mfg. Co.
303 — 8th Ave.
Lake City, Minnesota

EISLER TRANSFORMERS
* STANDARD and SPECIAL *
AIR — OIL or WATER-COOLED
Sizes from ¼ to 400 KVA



* FINE WIRE BUTT WELDERS •
* SPOT WELDERS *
EISLER ENGINEERING CO., INC.
747 South 13th St. Newark 3, N. J.

the business wasn't just a necessary evil but the source of the most profitable income in the steel industry. We have seen the wire industry through the diaper changing stage and on to school age. Now it is up to you younger lads to guide it through high school years and on to voting age. If under your direction the industry doesn't graduate at the head of the class, you can expect a few haunts from some of the oldsters. We gave you a start—a darned good start—you carry on from here.

★ ★ ★

The Wire Drawing Die

(*Continued from page* 71)

says now that it was an overactive thyroid that kept him going. The industry will some day erect a monument to that thyroid gland. **Gus** was like a blood-hound on the scent. He once left his wife on a street corner while he stepped across the street for a pack of cigarettes, met a man, got an idea, jumped a train, and came back five days later to wonder why his wife was all packed up and was advertising the furniture for sale. His name will be on the bronze tablet.

★ ★ ★

THE trouble with naming names is that there is no place to stop. There is a tendency to over-emphasize those who got around the country fastest, and under-estimate the sound, solid executive work of a **Dick Robbins, Ken Beardslee, or Earl Glen.** And what are we going to do about **Jackman, Preston, McDuff, Nitchie,** and the rest? Everybody contributed. **Jim Longwell,** when he sent along some information for this story, told me to be sure and mention the little wire machine in my cellar, and what it yielded. Yes, even I was in the act, back among the stage hands and scene shifters. I speculated about die stresses, power formulas, and the like, determined mathematically correct die shapes, argued them out with Jim, and proved them in my cellar. In our common stock of die lore there may be something traceable to that cellar.

★ ★ ★

WIRE ANNEALING FURNACES and PROCESSES
COIL LOADING and STRIPING MACHINES—WIRE SPIDERS
LEE WILSON ENGINEERING CO., INC.
Cleveland, Ohio • ACademy 4670

WIRE DRAWING MACHINERY AND EQUIPMENT
Rod Frames — 16″ Frames, 8″ Frames — Take-Up Frame, Wire — Pointers — Puller Tongs. — General and heat resisting alloy castings for wire mill use.
Circulars on Request.
E. J. SCUDDER FOUNDRY & MACHINE CO.
TRENTON, N. J.

TRAUWOOD
Patenting, Annealing, Tempering, Galvanizing, and Tinning equipment for wire.
TRAUWOOD ENGINEERING CO.
Cleveland, Ohio.

ROSS WIRE • ROD **OVENS**
J. O. Ross Engineering Corp.
350 Madison Avenue, New York 17, N. Y.
CHICAGO - BOSTON
DETROIT - LOS ANGELES

Designers and Builders of Gas-Fired Heat Treating Furnaces for Ferrous and Non-Ferrous Wire.
SURFACE COMBUSTION CORP.
Main Plant & General Offices:
Toledo, Ohio

METAL PICKLING EQUIPMENT
(Acid-Resisting)
Hairpin Type
Wire Pickling Yokes
CLARK E. GORDON, INC.
8-165 General Motors Building,
Detroit 2, Michigan

WIRE WORKING MACHINERY
"Offered for Prompt Shipment"
WATERBURY-FARREL Continuous Wire Drawing Machines No. O Sleeve Type, Motor Driven with A. C. Motors, ¼" Cap. and Down.
WATERBURY & MANVILLE Cold Headers and Thread Rollers.
NILSON & BAIRD Nos. 1, 2, & 324 Four-slides.
U. S. TOOL No. 33 MULTI-SLIDES.
SLEEPER & HARTLEY and TORRINGTON Coilers.
LEWIS & SHUSTER Round and Shaped Wire Automatic Straightening and Cutting Machines.
LEWIS No. 3-F & No. 4-F Flying Shear Wire Straightening & Cutting Machines.
NATIONAL MACHINERY EXCHANGE
128-138 MOTT ST. NEW YORK, N. Y.

LANCASTER, ALLWINE & ROMMEL
REGISTERED PATENT ATTORNEYS
Suite 438, 815—15th St., N. W.
Washington 5, D. C.

●

Practice
before U. S. Patent Office. Validity and Infringement Investigations and Opinions.
Booklet and form "Evidence of Conception" forwarded upon request.

KENNETH B. LEWIS
CONSULTING ENGINEER
Wire Mill Equipment, Layout and Practice
43 Midland St., Worcester, Mass.
Phone: Worcester 5-6033

THE WALLACE G. IMHOFF CO.
Consultants in Zinc Coating
(Hot Galvanizing)
Hot Dip Tinning — Hot Lead Coating
905 SOUTH BEDFORD STREET
LOS ANGELES 35, CALIFORNIA

Consultants on
SPRING DESIGN
Materials & Applications
Methods & Manufacturing
THE CARLSON COMPANY
277 Broadway New York 7, N. Y.
BArclay 7-2552

NEP · SUMFOAM
ACID INHIBITOR • PICKLING COMPOUND
THE WM. M. PARKIN CO.
HIGHLAND BLDG. PITTSBURGH 6, PA.

WOOD REELS and SPOOLS
AMERICAN WOODWORKING COMPANY
1" to 60" Diameters
OVER 50 YEARS EXPERIENCE
1674 No. Lowell Avenue
Chicago, Ill.

Wire Measuring...
PRODUCTIMETERS
Send for Catalog No. 40
Precision-built for accuracy and speed. Most complete line offered
DURANT MANUFACTURING CO.
1918 N. Buffum Street Milwaukee 1, Wisconsin • 118 Orange Street Providence 3, R. I.

TESTING MACHINES
for WIRE, RUBBER, PAPER, TEXTILES, etc.
SCOTT TESTERS, INC.
55 Blackstone St. • Providence, R. I.
"Standard of the World"

ADD my name to the list in the preceding paragraph, and heed the poet's injunction:

"Let not ambition mock their useful toil,
Their homely joys, and destiny obscure,
Nor grandeur hear with a disdainful smile
The short and simple annals of the poor.

* * * *

Full many a gem of purest ray serene
The dark unfathomed caves of ocean bear;
Full many a flower is born to blush unseen,
And waste its sweetness on the desert air."

★ ★ ★

New Surface Coating for Aluminum Announced by A. C. P.

THERE is a new surface treating chemical for aluminum which produces a protective coating in an extremely short time, usually 2 minutes or less. This chemical can be applied by dipping, spraying (in a power washer), or brushing the aluminum parts. It is called "Alodine" and was developed by the **American Chemical Paint Company**, Ambler, Pa.

★ ★ ★

DIPPING parts into a tank containing the "Alodine" bath, for example, requires but 2 minutes for the formation of an effective coating. Spraying the work in power spray washer equipment reduces this short time still further so that an excellent coating, iridescent in color, forms in about 20 seconds. When the "Alodine" chemicals are brushed on large surfaces—aircraft, tanks, etc. —the coating time ranges from 1 to 5 minutes.

★ ★ ★

HOWEVER, even in these brief processing periods, a coating of remarkable protective properties is formed. In actual performance and under severe corrosive conditions, Alodized aluminum compares favorably in its ability to anchor paint and stop corrosion with the best surfaces produced in even the most complicated processes.

★ ★ ★

Wire straightening & cutting.
Bright basic, size 6 to 14 ga.
Write or phone.
BROSKI BROS. WIRE & IRON WORKS
3916 Bennington, Kansas City, Mo.
Phone Wabash 3360

WANTED
Man to take charge of Copper Wire Enameling and Copper Wire Drawing. Excellent Opportunity. Permanent position. Located in Chicago. Reply Box No. 516 % WIRE & WIRE PRODUCTS.

No. 2 CLIMAX WIRE STRAIGHTENER
3 H.P. Motor Drive
Condition Like New
WEBER MACHINERY CO.
1807 E. 21 Street Cleveland, Ohio

AD THOUGHT

May we suggest that reading the ads be made a regular habit. And when you write to an advertiser for information, it helps us and identifies your inquiry to say you saw the ad in WIRE AND WIRE PRODUCTS. Will you do this?

— FOR SALE —

5,000 used R1 and R2 Tungsten carbide dies, mostly .060 - .070 size, Carboloy and other standard makes, in good condition, at 50c each.
12 rod frame, spider type, strippers at $10.00 each.
20—12" music wire blocks at $20.00 each.
1 Turks Head, draw bench type, 5/8 or 3/4" capacity at $350.00.
1 chain making machine Nilson, about #5 size, similar to anti-skid side chain at $2,500.00.
2 small 4 slide machines, smaller than 00, at $375.00 each.
8 tub type, fine wire drawing machines, 12 die, draw to .005 at $350.00 each.

BOX #517

Index to Advertisers

A

Acrometal Products, Inc. 104
Ajax Industrial Supplies, Inc. 103
Ajax Manufacturing Co. 10
Aluminum Company of America 7
American Brass Co., The 59
American Chemical Paint Co. 85
American Insulating Machinery Company..... 100
American Woodworking Company 106
Apco Mossberg Company 97
Apex Alkali Products Co. 25
Apco Mossberg Co. 97
Atlas Mineral Products of Penna. 90

B

Balloffet Dies & Nozzle Co., Inc. 102
Bethlehem Steel Co. 2
Bick, Hans Co., Inc. 103
Boyd, Chas. P. Corp. 79
Bridge Mfg. Co., Inc. 76

C

Carboloy Company, Inc. 1
Carl-Mayer Corp., The 14
Carlson Company, The 106
Champion Diamond Co. 103
Clark, J. L., Manufacturing Co. 87
Cleveland Tramrail Division of the
Cleveland Crane & Engineering Co. 27
Cochaud Wire Die Corporation 103
Continental Steel Corp. 16
Crepe-Kraft Co., The
Division of National Waterproof Papers, Inc. ... 104

D

Davis, R. L. Electric Co. 19
Du Pont, E. I. de Nemours, Co. 21
Durant Mfg. Co. 106
Durkee Mfg. Co. 98

E

Eastern Carbide Corp. 86
Eastern Tungsten Carbide Co. 103
Eastwood-Nealley Corp. 99
Eberbach & Son Co. 98
Eisler Engineering Co. 105
Electric Furnace Company ..... Back Cover
Emory, Robert J. Company 104
Entwistle, James L. Co. 4

F

Firth-Sterling Steel & Carbide Corp. 32
Fort Wayne Wire Die, Inc. 103

G

General Electric Co., The 26
Glader, Wm., Machine Works 77
Gordon, Clark E., Inc. 105

H

Hallden Machine Company 88
Harper Electric Furnace Co. 95
Haveg Corporation 104
Heil Process Equipment Corp. 104
Hoosier Carbide Die, Inc. 103
Howsam Spool Co. 98
Hubbard Spool Company 24
Hudson Wire Co. 8
Hughesville Machine & Tool Co. 82

I

Imhoff, Wallace G. 106
Indiana Wire Die Company 102
Industrial Ovens, Inc. 104

J

Johnson Steel & Wire Co., Inc. 91

K

Kelly Wire Die Corp. 103
Keystone Steel & Wire Co. 74

L

L. and H. Die Co. 103
Lancaster, Allwine & Rommel 106
Lewis, K. B. 106
Lewis, Machine Co., The 99

M

Magnuson Products Corp. 91
Magnus Chemical Co. 13
Malin & Company, The 104
Martin, Glenn L., Company 3
Metal & Thermit Corp. 92
Metal Carbides Corporation 104
Mettler Machine Tool, Inc. 78
Micro Products Company 73
Miller, R. H. Company, Inc. 15
Modern Plastic Machinery Corp. 93
Montgomery Company, The 105
Morgan Construction Company ..... 52 & 53
Mossberg Pressed Steel Corp. 83

N

National Annealing Box Co. 105
National Machinery Exchange 105
New England Butt Company 18
New England Wire Die Co. 103
Niles Steel Products Div., Republic Steel Corp..... 31
Nilson, A. H., Machine Co., The 96
Norton Company, The 93

O

Oakite Products, Inc. 101
O'Neil-Irwin Mfg. Co. 105
Owens-Corning Fiberglas Corp. 6

P

Pacific Coast Borax Co. 101
Paramount Wire Company 105
Parkin, Wm. M. Co., The 106
Pittsburgh Cut Wire Co. 81
Platt Brothers & Co., The 104
Porter, H. K., Inc. 100
Potter, Neil C. 104

R

Red Star Engineering, Inc. 92
Robertson, John Co., Inc. 12
Rockwell, W. S., Company 94
Roebling's, John A., Sons Company 11
Roos, Tool & Mfg. Co. 95
Ross, J. O., Engineering Corp. 105
Royle, John & Sons 20
Ruesch, H. J. Machine Co. 104
Rusch Wire Die Corporation 103

S

Sauereisen Cement Co. 105
Scott Testers, Inc. 106
Scudder, E. J. Foundry & Machine Co. 105
Seneca Wire & Mfg. Co. 75
Sjogreu Tool and Machine Co., Inc. 94
Sleeper & Hartley, Inc. 104
Standard Industrial Compounds 23
Steel Equipment Corp. 80
Surface Combustion Corp. 105
Swift & Company 5
Syncro Machine Company 17

T

Trauwood Engineering Co. 105
Twitchell, E. W., Inc. 96

V

Vascoloy-Ramet Corp. 28
Vaughn Machinery Co. ..... Front Cover
Vianney Wire Die Works 102

W

Waterbury Farrel Foundry & Machine Co. 30
Watson Machine Company ..... Inside Back Cover
Wayne Wire Die Co. 103
Wean Equipment Corp. ..... Inside Front Cover
Wickwire-Spencer Steel Division
Colorado Fuel & Iron Corp. 22
Willey's Carbide Tool Co. 97
Wilson, Lee, Engineering Co., Inc. 105
Wire & Textile Machinery, Inc. 99

Y

Youngstown Sheet & Tube Company 9
Youngstown Welding & Engineering Corp. 89

WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Directory, Index & Buyer's Guide.

ABRASIVES—
Norton Co., Worcester, Mass.

ACID INHIBITORS—
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

ACID-PROOF CONSTRUCTION
Haveg Corporation, Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.
Nukem Products Corp., Buffalo, N. Y.
Sauereisen Cements Co., Pittsburgh, Pa.

ANNEALING MACHINES—Open Flame
Syncro Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT—
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machy., Inc., Pawtucket, R. I.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ross, J. O., Engr. Corp., New York, N. Y.

BAR STOCK—Stainless Steel
Armco Steel Corp., The, Middletown, Ohio.
American Steel & Wire Company, Cleveland Chicago, New York.
Columbia Steel Co., San Francisco, Calif.
U. S. Steel Export Company, New York, N. Y.

BENDERS—
O'Neil Irwin Mfg. Co., Minneapolis, Minn.

BOBBINS—Braider & Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

BORAX—Wire Drawing
Pacific Coast Borax Corp., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES—Pneumatic
Entwistle, Jas. L. Co., Pawtucket, R. I.

BRAKES & SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

BRICKS—Acid Proof
Nukem Products Corp., Buffalo, N. Y.

CABLE LACQUERING OVENS—
Industrial Ovens, Inc., Cleveland, O.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

CASTINGS—Wire Mill
Scudder, E. J., Fdry. & Mach. Co., Trenton, N.J.

CEMENTS—Acid Proof
Sauereisen Cements Co., Pittsburgh, Pa.

CEMENTS—Refractory
Norton Co., Worcester, Mass.
Sauereisen Cements Co., Pittsburgh, Pa.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Magnuson Products Corporation, Brooklyn, N. Y.
Metal & Thermit Corp., New York, N. Y.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANERS—Metal and Hand
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Magnus Chemical Co., Garwood, N. J.
Metal & Thermit Corp., New York, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIP.—
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, O.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.
Metal & Thermit Corp., New York, N. Y.
Morgan Construction Co., Worcester, Mass.
Nukem Products Corp., Buffalo, N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

CLOTH TESTERS—
Scott Testers, Inc., Providence, R. I.

CLOTH—WIRE, All Metals
Roebling's, John A. Sons, Co., Trenton, N. J.
Wickwire Spencer Steel Division, Colorado Fuel & Iron Corp., Buffalo, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

COILERS—Sheet, Strip and Wire
Entwistle, Jas. L. Co., Pawtucket, R. I.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J. Machine Co., Newark, N. J.
Wean Equipment Corp., Cleveland, Ohio.

COLD HEADERS—
Ajax Manufacturing Co., Cleveland, Ohio.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Diamond
Magnus Chemical Co., Garwood, N. J.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Metal & Thermit Corp., New York, N. Y.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Magnuson Products Corporation, Brooklyn, N. Y.
Miller, R. H. Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Pacific Coast Borax Corp., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.
Swift & Company, Chicago, Ill.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Metal Carbides Corporation, Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, New York.
Vascoloy-Ramet Corp., North Chicago, Ill.
Willey's Carbide Tool Co., Detroit, Mich.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Champion Diamond Co., New York, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Champion Diamond Co., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Hoosier Carbide Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND TOOLS—
Carboloy Co., Inc., Detroit, Mich.
Eastern Tungsten Carbide Co., Newark, N. J.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Cold Heading
Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio.
Vascoloy-Ramet Corp., No. Chicago, Ill.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Carbide Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Eyelet
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.

DIES—Lead Extrusion
Carboloy Co., Inc., Detroit, Mich.
Eastern Tungsten Carbide Co., Newark, N. J.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
L. & H. Die Co., Royal Oak, Mich.
Metal Carbides Corporation, Youngstown, Ohio.
Robertson, John, Co., Brooklyn, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Eastern Tungsten Carbide Co., Newark, N. J.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
L. & H. Die Co., Royal Oak, Mich.
Metal Carbides Corp., Youngstown, O.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Rod and Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Eastern Tungsten Carbide Co., Newark, N. J.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
L. & H. Die Co., Royal Oak, Mich.

WHERE TO BUY, Continued

Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Sintered Carbide
Hoosier Carbide Die Co., Ft. Wayne, Ind.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Hoosier Carbide Die Co., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.

DIES—Tubing
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Hoosier Carbide Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
L. & H. Die Co., Royal Oak, Mich.
Metal Carbides Corp., Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRUMS—Flange Steel
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., The, Paterson, N. J.

DRYING EQUIPMENT—
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Modern Plastic Machinery Corp., Lodi, N. J.
Rockwell, W. S. Co., Fairfield, Conn.
Ross, J. O., Engineering Corp., New York, N. Y.

ENGINEERS—Consulting Spring Design
Carlson, Co., The, New York, N.Y.

ENGINEERS—Consulting Wire Mill
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Insulation Testing
Davis, R. L., Elec. Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M. Co., Pittsburgh, Pa.

FRICTION PAY-OFF STANDS—
Industrial Ovens, Inc., Cleveland, Ohio.

FURNACES—Annealing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Hayes, C. I., Providence, R. I.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Hayes, C. I., Providence, R. I.
Rockwell, W. S., Co., Fairfield, Conn.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Hayes, C. I., Providence, R. I.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Hayes, C. I., Providence, R. I.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio.

FURNACES—Galvanizing Equipment
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Rockwell, W. S., Co., Fairfield, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Hard'ing & Temp'ing
Ajax Electric Co. Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Hayes, C. I., Providence, R. I.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., The, Cleveland, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio.
Robertson, John, Co., Brooklyn, N. Y.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Co., Inc., Philadelphia, Pa.

FURNACES—Resistance Heating, Strand
Trauwood Engineering Co., Cleveland, Ohio.

FURNACES—Salt Bath
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corporation, Toledo, O.
Trauwood Engineering Co., The, Cleveland, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corporation, Toledo, O.
Trauwood Engineering Co., The, Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING EQUIPMENT—
Steel Equipment Co., Cleveland, Ohio.
Wean Equipment Corp., Cleveland, Ohio.

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

HOOKS—Pickling and Liming
Gordon, Clark E., Detroit, Mich.
Youngstown Welding & Engineering Co., Youngstown, Ohio.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
American Insulating Machine Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.

INSULATING MATERIALS—
Du Pont de Nemours, E. I., Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Martin, Glenn L., Company, Baltimore, Md.
Owens Corning Fiberglas Corp., Toledo, O.
Twitchell, E. W., Philadelphia, Pa.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Morgan Construction Co., Worcester, Mass.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co. Waterbury, Conn.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LININGS—Acid and Alkali Proof
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.
Sauereisen Cements Co., Pittsburgh, Pa.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co. Chicago, Ill.

LUBRICANTS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co. Chicago, Ill.
Swift & Company, Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Brazing
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H. Machine Co., The, Bridgeport, Conn.

MACHINERY—Cable, Rope Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Boyd, Charles P., Corp., Philadelphia, Pa.
Rockwell, W. S., Co., Fairfield, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

WHERE TO BUY, Continued

MACHINERY—Coilers
Boyd, Charles P., Corp., Philadelphia, Pa.
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (used), New York, N. Y.
New England Butt Co., Providence, R. I.
Ruesch, H. J. Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.
Wire & Textile Machinery, Inc., Pawtucket, R. I.

MACHINERY—Cold Heading
Ajax Manufacturing Co. Cleveland Ohio.

MACHINERY—Copper Wire Drawing and Rolling
Aetna Standard Eng'g Co., The, Youngstown, O.
American Insulating Mach'y Co., Phila., Pa.
National Machinery Exchange (used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Hallden Machine Co. Thomaston Conn.
Lewis Machine Co., The, Cleveland, Ohio.
Mettler Machine Tool, Inc., New Haven, Conn.
National Mach'y Exch. (Used) New York, N. Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
Porter, H. K., Inc., Everett, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Die Making
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Red Star Engineering, Inc., Rahway, N. J.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Aetna Standard Eng'g Co., The, Youngstown, O.
Ajax Manufacturing Co. Cleveland Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Edging
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.
Rockwell, W. S., Co., Fairfield, Conn.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Extruding
Modern Plastic Machinery Co., Lodi, N. J.
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Galvanizing
(See Galvanizing Equipment)

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Pawtucket, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Modern Plastic Machinery Co., Lodi, N. J.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Material Handling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Pawtucket, R.I.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Black Industries, Cleveland, Ohio.
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I

MACHINERY—Pickling
Gordon, Clark E., Detroit, Mich.
Youngstown Welding & Engineering Company, Youngstown, Ohio.

MACHINERY—Pointing
Aetna Standard Eng'g Co., The, Youngstown, O.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rod Mill
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rubber Insulating
Royle, John & Sons, Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Screw Wire
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila, Pa.
Black Industries, Cleveland, Ohio.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
New England Butt Co., Providence, R. I.
Red Star Engineering, Inc., Rahway, N. J.
Ruesch, H. J. Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Boyd, Charles P. Corp., Philadelphia, Pa.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Modern Plastic Machinery Co., Lodi, N. J.
National Mach'y Exch. (Used), New York, N.Y.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O. Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Ajax Manufacturing Co. Cleveland Ohio.
Hallden Machine Company, Thomaston, Conn.
Lewis Machine Co., The, Cleveland, Ohio.
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N.Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Stranding
Hughesville Machine & Tool Co., Hughesville, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Ruesch, H. J., Machine Co., Newark, N. J.
Steel Equipment Co., Cleveland, Ohio.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Swaging
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Foundry & Machine Co. Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Testing Physical
Eberbach & Son Co., Ann Arbor, Mich.
Scott Testers, Inc., Providence, R. I.

MACHINERY—Testing Equipment—Sparkers
Davis, R. L. Elec. Co., Wallingford, Conn.
Entwistle, Jas. L., Pawtucket, R. I.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Welding Wire
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wind-up (Constant Tension, Variable Speed)
Aetna Standard Eng'g Co., The, Youngstown, O.
Industrial Ovens, Inc., Cleveland, Ohio.
Modern Plastic Machinery Co., Lodi, N. J.
Watson Machine Co., Paterson, N. J.

WHERE TO BUY, Continued

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
Aetna Standard Eng'g Co., The, Youngstown, O.
Ajax Manufacturing Co. Cleveland Ohio.
American Insulating Mach'y Co., Phils., Pa.
Eisler Engineering Co., Newark, N. J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co. Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Wire Forming
Eisler Engineering Co., Newark, N. J.
National Mach'y Exch. (Used), New York, N.Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wood Screw
National Mach'y Exch. (Used), New York, N.Y.

MACHINERY—Wrapping Wire Coils
Angier Corporation, Framingham, Mass.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MATERIAL—Resistance Heating Strand
Trauwood Engineering Co., Cleveland, Ohio.

NAILS—Wire
American Steel & Wire Co., Cleveland, Chicago, New York
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling, John A. Sons Co., Trenton, N. J.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.
U. S. Steel Export Co., New York, N. Y.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.
Rockwell, W. S., Co., Fairfield, Conn.

OVENS—Dehydrogenizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Rockwell, W. S., Co., Fairfield, Conn.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Rockwell, W. S., Co., Fairfield, Conn.
Ross, J. O., Engr. Corp., New York, N. Y.

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Rockwell, W. S., Co., Fairfield, Conn.
Ross, J. O., Engr. Corp., New York, N. Y.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Pa.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Angier Corp., The, Framingham, Mass.
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.

PAPER—For Coil Wrapping and Corrosion Prevention
Angier Corp., The, Framingham, Mass.
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.

PAPER TESTERS—
Scott Testers, Inc., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D.C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

PICKLING—Hooks, etc. Acid Resisting
Gordon, Clark E., Detroit, Mich.

PICKLING TANK LININGS—
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.
Nukem Products Corp., Buffalo, N. Y.
Sauereisen Cements Co., Pittsburgh, Pa.

PIPES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio
Nukem Products Corp., Buffalo, N. Y.

PLASTIC TESTERS—
Scott Testers, Inc., Providence, R. I.

PNEUMATIC CYLINDERS
Entwistle, James L. Co., Pawtucket, R. I.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio

POTS—Lead Melting
National Annealing Box Co., Washington, Pa.
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Pa.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

REEL AND TENSION STANDS—
Davis, R. L. Electric Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Drawn Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS & SPOOLS—Collapsible
Entwistle, Jas. L. Co., Pawtucket, R. I.

REELS & SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg., Co., The, Hazardville, Conn.
Clark, J. L., Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Takeoff
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg., Co., The, Hazardville, Conn.
Clark, J. L., Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Vulcanizing & Impregnating
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Wire Drawing
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg., Co., The, Hazardville, Conn.
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS & SPOOLS—Wooden
Acrometal Products, Inc., Minneapolis, Minn.
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Durkee Mfg. Co., Pine River, Minn.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

RESISTANCE HEATING—Annealing, Patenting, Etc.
Trauwood Engr. Co., Cleveland, Ohio.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Rockwell, W. S., Co., Fairfield, Conn.
Ross, J. O., Engineering Corp., New York, N.Y.

RODS—Nickel Alloy
Eastwood Nealley Corp., Belleville, N. J.
International Nickel Co., Inc., New York, N.Y.

RODS—Stainless Steel
Armco Steel Corp., The Middletown, Ohio.

RODS—Wire—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Eastwood Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
American Steel & Wire Company, Cleveland, Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Roebling's John A., Sons Co., Trenton, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire-Spencer Steel, Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott Testers, Inc., Providence, R. I.

WHERE TO BUY, Continued

RUST PROOF COMPOUNDS—
(See Compounds—Rust Preventing)

RUST REMOVING COMPOUNDS—
(See Compounds—Rust Preventing)

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc., Pawtucket, R. I.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Armco Steel Corp., The, Middletown, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Potter, Neil C., Newark, N. J.
Swift & Company, Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Ovens, Inc., Cleveland, Ohio.

STAMPINGS—Steel
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Armco Steel Corp., The, Middletown, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, Ohio.
Youngstown Sheet & Tube Co., Youngstown, O.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., Paterson, N. J.

TANKS—Compound
Atlas Mineral Products Co. of Pa., Mertztown, Pa.
Haveg Corp., Newark, Del.
Nukem Products Corp., Buffalo, N. Y.
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Haveg Corp., Newark, Del.
Nukem Products Corp., Buffalo, N. Y.
Rockwell, W. S., Co., Fairfield, Conn.
Sauereisen Cements Co., Pittsburgh, Pa.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.
Rockwell, W. S., Co., Fairfield, Conn.
National Annealing Box Co., Washington, Pa.

TINSEL—Cords, Decorative
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, New York

TINSEL—Electric Conductor
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, New York

TINSEL—Electric Resistance
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, New York

TINSEL—Lame, Silver and False Gold
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, New York

TINSEL—Thread, Silver and False Gold
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, New York

TINSEL—Thread, Decorative
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, New York

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRAVERSES—For Reels
Entwistle, James L. Co., Pawtucket, R. I.
Hubbard Spool Company, Chicago, Ill.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

TUBE BENDERS AND FORMERS—
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Ruesch, H. J., Machine Co., Newark, N. J.

VALVES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—For Insulation
General Electric Co., Schenectady, N. Y.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago Ill.
Sciaky Bros., Inc., Chicago, Ill.

WIND-UP AND UNWIND SYSTEMS—Continuous
American Insulating Mach'y Co., Phila., Pa.
Davis R. L. Electric Co., Wallingford, Conn.
Entwistle, James L. Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

WIRE—Aluminum
Aluminum Co. of America, Pittsburgh, Pa.
Malin & Co., Cleveland, Ohio.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
Armco Steel Corp., The, Middletown, Ohio.
American Steel & Wire Co., Cleveland-Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
U. S. Steel Export Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Electric
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Enameled for Coils
North American Philips Co., Inc., New York, New York
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Armco Steel Corp., The, Middletown, Ohio.
American Steel & Wire Co., Cleveland-Chicago & New York
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Manufacturing Co., The, Fostoria, Ohio.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div. of Colorado Fuel & Iron Corp., Buffalo, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Music
American Brass Co., The, Waterbury, Conn.
American Steel & Wire Co., Cleveland-Chicago, New York
Columbia Steel Co., San Francisco, Calif.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., Cleveland, Ohio.
Paramount Wire Co., New York, N. Y.
U. S. Steel Export Co., New York, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

WIRE—Nickel & Nickel Alloy
Eastwood-Nealley Corp., Belleville, N. J.
International Nickel Co., Inc., New York, N.Y.

WIRE—Nickel Silver and Phosphor Bronze
American Brass Co., The, Waterbury, Conn.
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Non-Ferrous to Specification for Special Purposes
American Brass Co., The, Waterbury, Conn.
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.
North American Philips Co., Inc., New York, New York.
Paramount Wire Co., New York, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRESERVING—Paper and Cotton
Paramount Wire Co., New York, N. Y.

WIRE—Spring
American Steel & Wire Co., Cleveland-Chicago
Armco Steel Corp., The, Middletown, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Indiana.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
U.S. Steel Export Co., New York, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
Armco Steel Corp., The, Middletown, Ohio.
American Steel & Wire Co., Cleveland-Chicago, New York
Columbia Steel Co., San Francisco, Calif.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
U. S. Steel Export Co., New York, N. Y.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Paramount Wire Co., New York, N. Y.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting—
Paramount Wire Co., Inc., New York, N. Y.
Pittsburgh Cut Wire Co., Pittsburgh, Pa.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE CLOTH—Industrial
Roebling's John A., Sons Co., Trenton, N. J.
Wickwire Brothers, Cortland, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

WIRE TESTERS—
Scott Testers, Inc., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Paramount Wire Co., New York, N. Y.

WRAPPING PAPER—Creped
Angier Corporation, Framingham, Mass.
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.

YARNS & TAPES—
Du Pont de Nemours, E. I., Co., Wilmington, Delaware
General Electric Co., Schenectady, N. Y.
Owens Corning Fiberglas Corp., Toledo, Ohio.
Twitchell, E. W., Philadelphia, Pa.

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

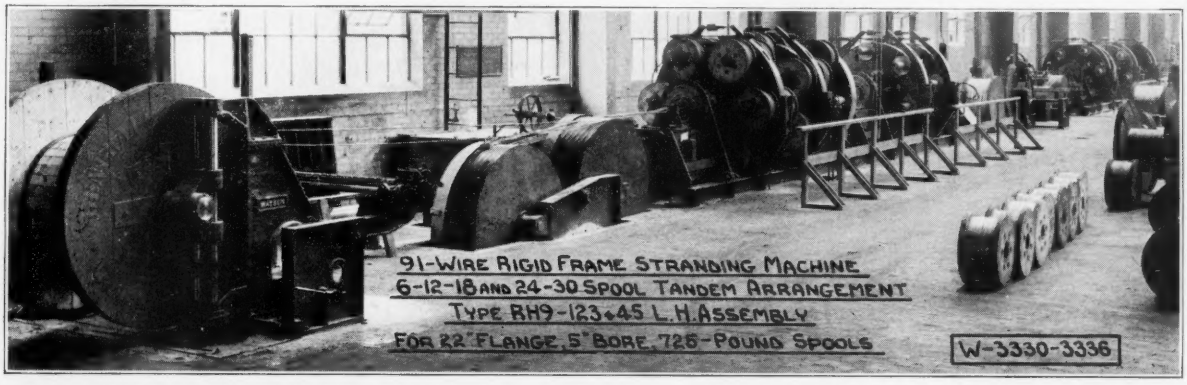
ESTABLISHED 1845

PATERSON 3, NEW JERSEY, U. S. A.

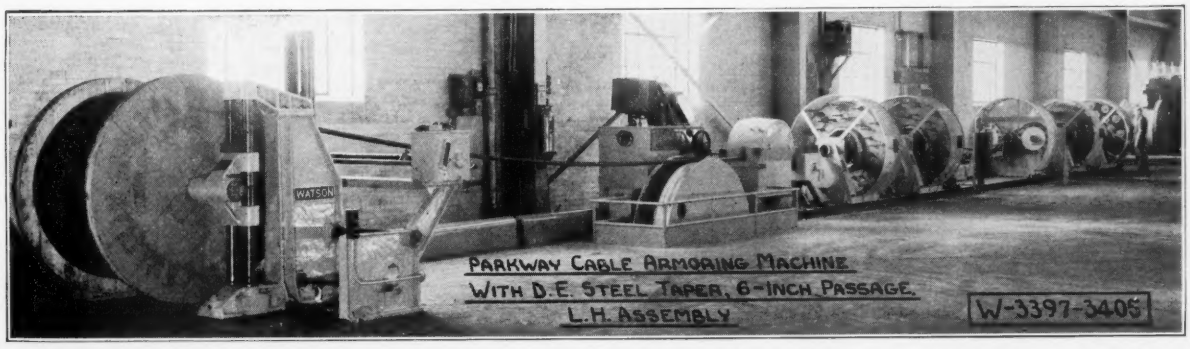
WATSON

ELECTRICAL WIRE AND CABLE, WIRE ROPE AND CORDAGE MACHINERY

THROUGH THE COURTESY OF THE CANADIAN GENERAL ELECTRIC COMPANY, LIMITED, we are enabled to depict here two examples of the many complete machines built by us. Design is fully up to date and installation of both machines was but recently completed.


91-WIRE RIGID FRAME STRANDING MACHINE
6-12-18 AND 24-30 SPOOL TANDEM ARRANGEMENT
TYPE RH9-123-45 L.H. ASSEMBLY
FOR 22" FLANGE, 5" BORE, 725-POUND SPOOLS
W-3330-3336

91-WIRE STRANDER RH9—123&45. Arranged for TANDEM OPERATION. Permits single-pass 91-wire concentric layer stranding—or—both machine sections, each with its own capstan and takeup, can be operated independent of each other. Flexibility is unexcelled and repeat passes produce any desired construction. Ideal for soft copper and wire of similar ductility. Much higher production and lower machine cost as compared with planetary machines of similar utility. All heads are reversible and disconnectible. Heads are of anti-friction bearing and steel construction throughout. Automatic layhead and spool latch stops on each head. Open construction and overhung spool mount reduce loading and threading time to an absolute minimum. "Tilted" Capstan Sections prevent side-scuffing and the double grooved design is capable of the heaviest pulls and suitable for sector stranding. Fully motorized automatic Take-ups and Traverses. Machine overall length is 142 feet.



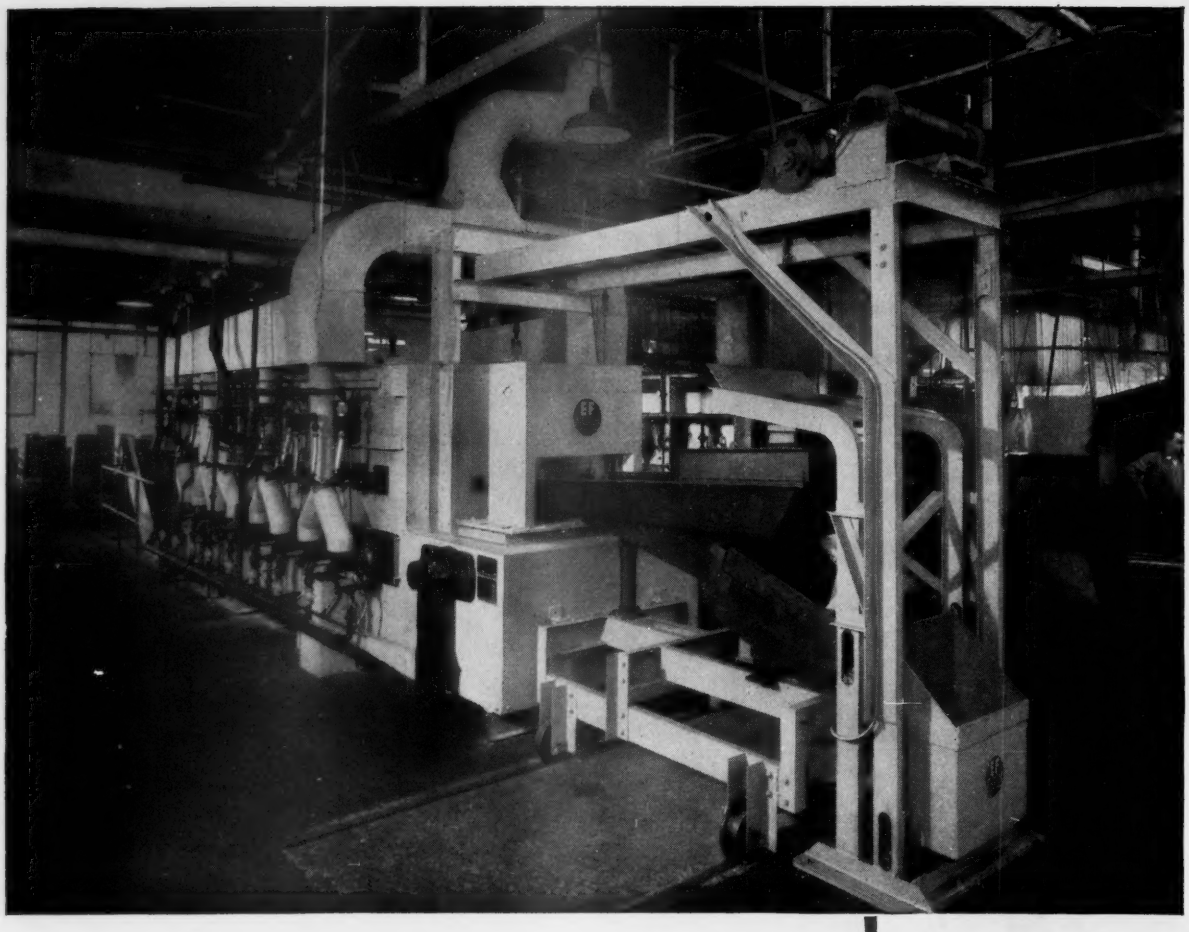
6-INCH PARKWAY MACHINE. An ideal machine arrangement for the insulating and steel tape armoring of underground power cable. The machine shown mounts units in the following order:

Hydraulic Lift Letoff 84"
Electric Compound Tank
48-Cop Juter
Electric Compound Tank
48-Cop Juter
Electric Compound Tank
Steel Taper 28" D.E.
Electric Compound Tank
48-Cop Juter
Electric Compound Tank
48-Cop Juter
Electric Compound Tank
Motorized Wet Chalker
Capstan mounted 20-H.P. Drive
Single Tapered 80" Capstan
10-Ton Shaftless 96" Takeup

Machine overall length is 120 feet.

★ ★ ★

Individual machinery bulletins available on all units employed in above machines.



LOW COST HEAT TREATMENT

of small and medium size parts

● The EF chain belt conveyor furnace—with its specially designed heat resisting cast link conveyor belt—is one of the most satisfactory continuous heat treating units yet devised for the scale-free hardening, carbon restoration and non-decarb heat treating of small and medium size parts. Ideally used with bolts, chains, gears, pinions, rivets, tools, tractor treads and a wide variety of other forged, drawn, stamped, machined, headed and welded pieces. Built in eleven standard sizes with capacities up to 2000 pounds per hour. Larger sizes also available. Gas fired, oil fired or electrically heated, whichever best suits your particular requirement—and location. Estimates of equipment, installation and operating costs—and samples of heat treated parts—furnished promptly. Write for literature today.

EF

GAS-FIRED
OIL-FIRED
and ELECTRIC

FURNACES

for

- AGING
- ANNEALING
- BRAZING
- ➤ CARBON RESTORATION
- CARBURIZING
- CERAMIC DECORATING
- DRAWING
- ➤ HARDENING
- HOMOGENIZING
- MALLEABLIZING
- NORMALIZING
- NITRIDING
- SINTERING
- SOLUTION TREATING
- ➤ SPECIAL ATMOSPHERE TREATMENTS

THE ELECTRIC FURNACE CO.

A SIZE AND TYPE OF FURNACE FOR EVERY PROCESS, PRODUCT OR PRODUCTION

WILSON STREET *Salem - Ohio*